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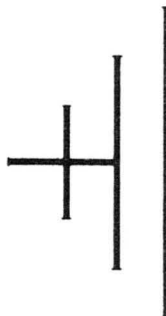
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NATIONAL SECURITY POLICY ISSUES  
IN U.S.-SOVIET  
TECHNOLOGY TRANSFER

By  
Herman Kahn  
and  
William Schneider, Jr.

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~~DRAFT~~ FINAL REPORT

NATIONAL SECURITY POLICY ISSUES IN U.S.-SOVIET  
TECHNOLOGY TRANSFER

By

Herman Kahn and William Schneider, Jr.

with contributions from

Frank E. Armbruster  
Basil J. Candela  
Alexander O. Ghebhardt  
David P. Harmon, Jr.  
Rachel Welber  
Doris Yokelson

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## SUMMARY AND CONCLUSIONS

Summary

1. Hudson Institute has conducted a one-year study of major national security policy issues that arise from technology transfers between the U.S. and the Soviet Union.

The purpose has been to identify and evaluate major issues in security policy resulting from greater commercial relations between the United States and the Soviet Union. These security problems will interact with a wide range of other problems, and will ultimately influence the magnitude and composition of U.S.-Soviet trade. Of particular concern will be: the nature of the Soviet demand for imports and the Soviet supply of exports; the technology assimilation process in the Soviet Union; and the institutional arrangements which will be necessary to support U.S.-Soviet trade.

Hudson has used several types of research techniques in order to develop the necessary supporting information for this study. We have conducted a traditional review of secondary source material dealing with U.S.-Soviet trade and technology transfers. In addition, we have surveyed foreign technology sales and technology exchange agreements with the Soviet Union between August 1972 and June 1973. This survey was conducted to specify the nature of Soviet import demand. Moreover, we conducted a series of interviews and seminars with major participants in U.S.-Soviet technology transfers. These participants included academic and government analysts of the Soviet economy, business and financial executives currently engaged in, or financing, technology transfers and trade with the Soviet Union, and American labor leaders.

2. The institutional arrangements of U.S.-Soviet trade are quite unlike ordinary trading agreements, as typified by the arrangements with other U.S. trading partners. We suggest that these institutional arrangements reflect the likely character of long-term U.S.-Soviet technology exchanges. The preferred Soviet technique is a sophisticated barter arrangement: the U.S. sells advanced technology to the U.S.S.R. and is eventually paid through the output of a factory employing the technology which was originally sold. This arrangement involves long-term financing, especially with U.S. Government support if it is to be commercially feasible.

This is a substantial change from the prior Soviet practice of simply purchasing "critical" foreign technology. It is rather an attempt to procure entire systems which embody foreign technology. Consequently, on a long-term and large-scale basis, these transfers will require an accommodating set of institutional arrangements in the United States. These arrangements will almost certainly involve U.S. Government participation if major trade is to be sustained.

3. In general, the Soviet Union has a virtually insatiable requirement for imported technology, particularly for its agriculture and industry. At present, the U.S.S.R. prefers large-scale transactions with the United States because the Soviets perceive that the size of the U.S. economy is compatible with that of the Soviet economy. However, we point out that the U.S. is not the preferred supplier of foreign technology. Our survey indicates that the Soviets have tried to diversify their procurement in order to deal with all the major Western industrial nations. The only common characteristic of these transactions is that the Soviets try to seek the most advantageous terms for their purchases.

Some significant differences are noticeable in the exchange of scientific and industrial information. For example, about 70 percent of the information exchange agreements with West Germany concerned scientific-technological cooperation--especially with joint R&D--but only one-third of the agreements with the United States were of this character. The U.S. emphasizes industrial cooperation where reciprocal benefits are more difficult to identify.

The Soviets do not seem to employ their imported technology for the priority modernization of any particular economic sector. Rather, they behave as if foreign technology imports were being rationed among a considerable number of Soviet ministries which are all seeking to upgrade their individual efficiencies.

4. We can suggest several hypotheses concerning the Soviet process of technology assimilation. Five models have been examined:

- A. U.S.-guided technology assimilation model
- B. A bureaucratic independence model
- C. A model led by exports
- D. A model of central planning
- E. A civilian/defense priority model

More information about Soviet decision-making would be needed in order to develop a truly satisfactory explanation of the Soviet process of technology assimilation. Each of the models identified above implies different consequences for U.S. policy. Moreover, Soviet import demands will be substantially different depending on which model is most applicable to the Soviet process.

The export-led model would imply the least serious effects on U.S. national security interests because Soviet development would be channeled into export-oriented industries. On the other hand, the most serious concern would be raised by the defense priority model, as technology imports would be rationalized to enhance the effectiveness of the Soviet defense industries.

5. The Soviet Union may be seen as an underdeveloped country in terms of its export potential. In the near-term and medium-term, we may expect the Soviet Union to continue to export primarily primary products and to be a net importer of manufactured goods. In fact, the extent of the Soviet export potential will be a determining factor in setting the level of Soviet trade with the West.

It is noteworthy that the Soviet debt-service ratio can be expected to rise as high as 50 percent by 1980, as a result of many years of Soviet trade deficits with the Western nations. This ratio is far larger than would normally be considered to be commercially viable, and it expresses the nature of the U.S.-Soviet trade problem. Ultimately, Soviet imports will be constrained by the Soviet export potential. Unless foreign governments or businesses are willing to finance the Soviet economy indefinitely, the Soviet Union will have to earn sufficient revenue from exports to finance their technology imports.

The most promising Soviet exports are natural gas and gold. Given the Soviet constraints, these two commodities may be expected to be the largest foreign exchange earners for the Soviet Union. If the U.S.S.R. cannot develop its natural gas reserves to a large-scale export level, then high levels of Soviet technology imports cannot be expected to be

sustained. The Soviet Union's other large-scale industrial and extractive industries could provide significant foreign exchange only on a long-term basis, and are unlikely to provide major economic assistance within the next decade.

6. Because of the heterogeneous character of any modern military establishment, national security interests will pervade the entire range of U.S.-Soviet commercial relationships. These relations will have direct and indirect effects on the efficiency of the Soviet military establishment. The issue is not whether an impact will exist, but rather how great will be its significance. Sometimes the national security interest will be paramount, depending upon the types of goods and services traded and their interaction with the process of technology assimilation in the Soviet Union.

The U.S. Government faces two major types of policy choices in its future technology transfers with the Soviet Union. The first set of decisions concerns the objectives to be pursued through commercial activity. The U.S. might wish to encourage technology sales which could have the most direct impact on the Soviet ability to develop its export capacities. Alternatively, U.S. aims might include an economic warfare perspective to the extent that sales to the Soviet Union would impose a maximum infrastructure cost on Soviet resources and the Soviet economy; this would consequently limit the Soviet ability to divert resources to their defense industries.

Another set of decisions concerns the political effects of large-scale U.S.-Soviet commercial relations. A number of threat reduction trade-offs could be usefully considered in order to interrelate high volumes of U.S.-Soviet trade with a reduction in the most significant types of Soviet threats to the security of the United States.

Conclusions

1. Potential military applications of U.S.-Soviet technology are but one of the many national security implications of U.S.-Soviet technology transfers.

2. The crucial macroeconomic characteristic of U.S.-Soviet technology transfers is the magnitude of general U.S.-Soviet trade. The level of trade will influence both the present composition of technology transfers and its ultimate impact on the Soviet process of technology assimilation.

3. If U.S. trade with the Soviet Union is at a high level--more than \$2 billion in American sales annually--this will probably result from Soviet imports of entire U.S. technology systems, such as electronic component production, agricultural systems, food-processing technology, and transportation systems. Lower levels of trade will probably result from piecemeal importing by the U.S.S.R. of critical foreign technologies, such as computers, the technology of specialized extractive industries, or management information systems.

4. Direct questions of national security arise from the potential Soviet imports of entire U.S. technology systems. In the international export market for advanced technology, the U.S. comparative advantage lies in our ability to integrate technology subsystems into effective large-scale systems. If Russia assimilates technologies which support military production, such as electronics and transportation, this could have a major impact in enhancing the efficiency of the Soviet military and civilian sectors. The U.S.S.R. shows a preference for "turnkey" projects, thus emphasizing their interest in procuring large-scale systems of foreign technology, rather than critical subsystems.

5. Soviet imports of other technology would have indirect effects on the efficiency of their military and civilian industries. The results could enhance efficiency to the extent that resource allocation was improved; on the other hand, efficiency could be degraded if the process of assimilating imported technology also required the diversion of large resources and expenditures for infrastructure development.

6. Our evidence in this study suggests several alternative hypotheses about the Soviet process of technology assimilation. The simplest explanation of their technology import priorities supports the model of bureaucratic independence: in this model, no particular element of the Soviet economy appears to be ignored in its claims for foreign technology. More information is required about Soviet decision-making before more definitive conclusions can be drawn about the Soviet exploitation of existing technology imports.

7. Undeniably, the transfer of large-scale advanced technology systems from the U.S. will affect the efficiency of Soviet military forces. The effects will be seen both directly in support of military missions, and indirectly by enhancing the Soviet allocation of civilian resources. It does not seem feasible to control, through the use of selective export controls, either the process of technology transfer between Soviet military and civilian sectors or the whole process of technology assimilation. Thus, transfers of large-scale U.S. technology should be carefully negotiated within a context of reducing the Soviet military threat in the process, either by Soviet military manpower reductions, or reduced deployment of Soviet strategic nuclear delivery forces, or other offsetting reduction of forces.

8. Export controls should be applied to the transfer of critical subsystems which embody advanced U.S. technology. Where both civilian and military applications exist for this technology, the U.S. should consider what might be the best Soviet military applications of the technology and the effects if military applications are employed. For example, if the best military applications of some technology subsystem would improve the efficiency of Soviet strategic forces--even if there may also be legitimate civilian applications--this transfer should be disapproved. The enhancement of Soviet strategic strength would be the threat that the United States is most anxious to mitigate. On the other hand, if the best military application of a subsystem were to pose only a low-priority military threat to the U.S., then such sales could be approved with reduced risk to U.S. security.

NATIONAL SECURITY POLICY ISSUES IN U.S.-SOVIET  
TECHNOLOGY TRANSFER

I. INTRODUCTION

"Power implications are inherent in trade.  
They may be ignored, but nevertheless they  
exist."

James R. Schlesinger (1960)\*

The Realpolitik implicit in Secretary Schlesinger's remark should not obscure the real differences that exist between competent observers about the coupling between economic interdependence and international harmony. Contemporary policy-makers would not only support Schlesinger's view but would also agree with the famous dictum of John Stuart Mill:

"It is commerce which is rapidly rendering war obsolete by strengthening and multiplying the personal interests which are in natural opposition to it."\*\*

The current notion is that U.S.-Soviet trade constitutes "an investment in peace" because of the interdependency created by trade. It is argued that mutually beneficial trade will attenuate conflict which might arise in the absence of trade; a mutuality of interest in continued trade will be a deterrent to conflicts.

By contrast, John Maynard Keynes argued that economic autarky is a more viable international economic framework than interdependence. He stressed the tensions which he felt were inevitable in a situation of

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\*The Political Economy of National Security (Praeger, New York, 1960), pp. 139-140.

\*\* Quoted in Schlesinger, ibid., p. 139.

economic interdependence.\* As an illustration, we should note the anti-U.S. nationalism aroused in Canada, Latin America and Europe by the trading operations of U.S.-owned multinational corporations.

For the past three decades, the U.S. and its allies have maintained a system of export controls over the flow of its foreign trade. Advanced technology with potential military applications has also been controlled, particularly in trade with enemies or potential enemies. The efficacy of these controls has become increasingly criticized, but whether such criticism can be justified depends upon the expectations held for the value of these controls. Much of the criticism is based on a view that assumes that technology can be denied through controls.\*\* In fact, it is questionable whether controls can be used to deny access to technology.

Export controls have been considered to be a device for influencing Soviet behavior and capabilities. But this influence would have to work in a set of very difficult circumstances. Controls have been thought to be capable of preventing the U.S.S.R. from acquiring a particular military capability, or of redirecting Soviet behavior in a specific manner.

The efficacy of controls has not been examined against a much looser standard. We should ask whether controls can influence the timing of Soviet acquisition of certain military capabilities, using indigenous means and assuming a Soviet inability to procure foreign technology.

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\* J.M. Keynes, "National Self-Sufficiency," Yale Review, Summer, 1933, pp. 756-58.

\*\* See for example, F.D. Holzman, "East-West Trade and Investment Policy Issues: Past and Future," in Soviet Economic Prospects for the Seventies, Joint Economic Committee, Congress of the United States, June 27, 1973, pp. 660-89.

Alternatively, we might ask whether controls could influence the cost to the Soviet economy of acquiring certain capabilities; this cost would represent a reallocation of resources to support the development of technical capabilities which otherwise might have been imported. If these looser standards of judging controls were accepted, export control might not be seen as "an utter failure," as some recent commentators have suggested.

There may be many reasons why U.S. export control policy toward the Soviet Union might be changed. This does not alter the possibility that export controls can achieve certain limited objectives for a limited period of time. The more relevant policy questions, then, concern the extent to which controls can have an important impact on U.S.-Soviet relations.

As an example, the denial of certain types of computer capabilities might inhibit the development of highly-accurate Soviet military guidance and control systems for a sufficient period to slow down the progress of Soviet strategic forces. This time delay might be adequate to improve the chances for negotiating an arms limitation agreement and therefore might constrain the nature of the Soviet threat to the United States. In these circumstances, the denial of technology could serve useful policy ends.

Thus, it cannot be said that export controls fail to serve some limited purposes. Neither the Soviet Union nor the United States needs to trade, in terms of its simple security interest. Both superpowers prefer to trade where these transactions can enhance the efficiency of their internal economic system and resource allocation process, by providing a lower-cost combination of inputs. What is distinctive in the U.S.-

Soviet case is the as-yet unknown impact of this trade on internal political systems within the U.S.S.R., and in particular its effects on the balance between civilian and military activities.

We attempt here to improve the level of understanding of the relationship between U.S. national security objectives and an increased level of technology transfer between the U.S. and the Soviet Union. We have used a variety of means for this study, including traditional secondary research and analysis, and an extensive series of interviews and seminars with American and foreign participants in the process of trade and technology transfer with the Soviet Union.

We have conducted research in several areas where an important impact on national security from technology transfers can be identified. In many cases, the security policy implications arise in circumstances where U.S. "civilian" technology is commercially transferred to the Soviet Union. We may characterize the impact of these transfers only after reviewing some of the critical dimensions of the Soviet use of technology transfers and the potential impact of these transfers.

American analysts of the Soviet Union have estimated that a high volume of U.S.-Soviet trade could reach \$3 billion per year by the end of the decade.\* This level of trade would raise for the first time questions about the consequences of substantial U.S. sales of advanced technology products to the Soviet Union. We have examined a set of public policy issues which are likely to be significant for the next five to fifteen years. Some of these issues are vastly more important than others. But many of

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\* See the study by John Hardt and George Holliday for the House Foreign Affairs Committee in 1973.

the questions have the character that the whole is greater than the sum of its parts: the interaction of these issues may be more important than any of the issues considered separately. We cannot at this time characterize the nature of that interaction.

1. Soviet Economic Capacity to Absorb Advanced Technology

A significant fraction of Soviet purchases of advanced Western technology has been directed toward eliminating bottlenecks in Soviet agriculture and services, as well as in Soviet industry. This trade often presumes a substantial Soviet investment in infrastructure, in order to support the advanced technology which is being imported. If the infrastructure is not adequate to permit reasonably efficient assimilation, the result might be to degrade rather than to enhance the efficiency of the Soviet economy.

2. The Political Infrastructure

U.S.-Soviet trade has increasing interactions with other issues within the societies of both superpowers. For the U.S., co-production schemes in which the U.S. will construct factories in the Soviet Union generates considerable hostility among organized labor organizations. For the Soviet Union, the American practice of financing based on market rates of interest is in conflict with traditional Marxist doctrine concerning interest payments. In both cases, political practices and customs may influence the character of trade and its overall level.

### 3. The Payments Mechanism

If U.S.-Soviet trade reached high levels, it would constitute the greatest volume of trade between the U.S. and any country having an inconvertible currency. Since substantial deficits in the Soviet balance of payments will be the likely consequence of high U.S.-Soviet trade, the nature of the financing will become an extremely important issue. New institutional arrangements may be required and new commercial practices may have to be integrated into trade arrangements. If the Soviet debt service ratio reaches 50 percent by the end of this decade, alternative mechanisms must be found to generate funds for the payment of Soviet imports other than from export earnings. Gold sales are one possibility, as are sales of other precious metals. The feasibility of nonstandard financing is unresolved, and in some ways it is even uncharted.

### 4. The Soviet Supply of Exports

The long-term character of U.S.-Soviet trade will depend upon the Soviet ability to pay for imports with their export earnings. It is therefore necessary to project the level and distribution of Soviet exports. To export effectively, the Soviet Union must develop products whose characteristics of price, quantity and quality are equal to those produced by competitors. These exports must be sold in a sufficiently high volume to equal eventually the Soviet level of imports. It is necessary to identify those goods and services where the Soviet Union will have a comparative advantage in the traditional economic sense.

## 5. The Soviet Demand for Imports

The nature and distribution of the Soviet demand for imports is equally important. Presently, the Soviet Union seems to be focusing on imports for high-priority areas of the economy; they are willing to pay in hard currency on delivery. But the available evidence is not very revealing about Soviet preferences for imports. For one thing, trade is currently at a level which is only about one-third of the rate projected for the late-1970s.

Soviet import demands may be influenced by many factors. For example, the Soviet Union decided to increase the quantity of meat in the Russian diet as a means to supplement grain as the traditional source of protein. This will depend upon imports of feed grains or on the Soviet assimilation of imports of U.S. feed-lot technology. But successful assimilation will depend on development of rural transportation systems, improvements in farm marketing, and related factors that are essential to efficient feed-lot operation. If the Soviets do persist in attempting to increase the meat supply, however, this may alter the character of Soviet import demands. They may require additional imports to substitute for any inefficient economic arrangements.

Import demand will also be influenced by Soviet defense priorities. Some fraction of Soviet imports of advanced American technology is certainly designed to free resources for the military sector. To the extent that an increasingly high priority is given to the effectiveness of Soviet military forces, then import demands will be weighted towards satisfying military requirements and might thereupon impart a substantially different character to imports.

#### 6. U.S.-Soviet Institutional Arrangements

At higher levels of U.S.-Soviet trade, many new questions will arise about the adequacy of existing institutions to support this trade. The Soviet technique of negotiating through state monopoly trading organizations gives them a substantial bargaining advantage in comparison to individual U.S. companies. American firms are generally prohibited from collaborating in international trade because of domestic anti-trust statutes. The U.S.S.R. can thus misuse proprietary U.S. corporate data for bargaining advantages. There are also wide disparities in U.S. and Soviet techniques for marketing, financing and commercial practices in general. The institutional framework could therefore influence the way in which trade develops, the nature of the firms participating in trade, and the type of products which would be traded.

#### 7. Exchange Rate Adjustments

The Soviets may also gain a comparative advantage by adjusting the exchange rate of the rouble. By maintaining a "two-tier" exchange rate system, the U.S.S.R. gains the equivalent of an export subsidy. This may be a more efficient mechanism than traditional Soviet tactics for obtaining trade advantages. Many Soviet products which are competitive in quality and availability are nevertheless too costly at current exchange rates; they may be competitive in the future at alternative exchange rates. The manner in which the Soviet Union seeks to maintain its exchange rate will thus have an important effect on overall U.S.-Soviet trade.

### 8. Multilateral Trade

The Soviets might also improve their foreign exchange earnings through multilateral trade. They may have many areas of comparative advantage in the markets of third parties. The U.S.S.R. may benefit from cheaper and simpler shipping costs in sending extractive products to Japan and Western Europe, which both hold large U.S. dollar credits. Certainly it is cheaper and less complicated to pipe natural gas to Western Europe than it is to liquify the gas and ship it in cryogenic tankers to the United States. Some comparative advantage may also exist for Soviet crude steel production. Thus, the Soviet Union could earn hard currency in third markets for use to finance U.S.-Soviet trade. Strangely enough, the U.S.S.R. has not shown much interest in multilateral trade, perhaps because of the low level at which it has been conducted in the past. Multilateral arrangements might become much more important once U.S.-Soviet trade reaches a higher level.

### 9. Cutbacks in Meat Production

The Soviets could also improve their reserves of hard currency by adjusting their import demands. One method would be to reduce the vast drain on their hard currency reserves caused by importing feed grains. They could then import a larger amount of U.S. farm technology and equipment. This might require a cutback in meat production for a number of years. But the U.S.S.R. made explicit promises to increase their meat production, partially to improve public morale, and it would cause some serious consequences if meat was cut back. Other consumer products might be found to attract greater consumer spending, but some of them such as

improved housing with higher rents, are difficult for the Soviet Union to provide for ideological reasons.

10. Shifts in Resources Between the Military and Civilian Sectors

It is widely assumed that the Soviet military sector has a first priority for technical personnel and the production of goods and services. Thus, the Soviet military industries are thought to be considerably more efficient than the civilian sector. Yet it seems that there are important bottlenecks within the Soviet military establishment, which might be reduced by infusions of advanced technology.

An important question is the extent to which civilian resources can be reallocated to the military, if the civilian economy becomes more efficient as a result of higher trade with the West. It has always been difficult to shift resources between industries in the Soviet Union for institutional and bureaucratic reasons. But we do not know enough about the character of civilian-military resource shifts. The more readily that resources can be shifted, the greater will be the benefit to the Soviet military from U.S.-Soviet technology transfers.

Another possibility is that, as civilian production is improved, all workers will develop greater productivity, including those in the defense sector. The injection of U.S. technology and feed grains will improve civilian production with no penalty to defense production; it will thus improve productivity in both defense and non-defense sectors.

## 11. Special Issues

American purchases of Soviet natural gas would be especially important. A very large investment by the U.S. and perhaps other countries would be required. This investment would be channeled to pipelines, liquefaction facilities and means of transportation and shipping to domestic U.S. markets.

The attractiveness of natural gas, as compared to alternative energy sources, would depend critically upon its price in U.S. markets. At a very high price for natural gas, the competing coal gasification might be a more effective alternative. On the other hand, very cheap Soviet natural gas might inhibit American development of alternative domestic energy sources, while increasing the attractiveness of the Soviet Union as a principal natural gas supplier.

For the U.S.S.R., natural gas is by far the largest potential earner of foreign exchange. It is thus the crucial ingredient in the long-term Soviet ability to finance its trade deficits resulting from imports of U.S. and European advanced technology.

Equally important for the long-term ability to finance trade deficits would be a Soviet decision to export some of their domestic gold production for hard currency. Considerable ambiguity exists about the extent of Soviet gold production, its relative costs, and the likelihood that the Soviets might expend virtually their entire monetary gold stock in the next one or two decades. But a failure to develop adequate export earnings and Western credits might compel the Soviet Union to abandon higher levels of U.S.-Soviet trade.

## 12. Soviet Economic Development

The trend of Soviet economic development will interact significantly with these other forces. Major shifts in development might include change in protein sources from grains to beef; a shift from economic autarky to limited international economic integration; a shift from heavy industries to other areas of economic activity where the Soviets may have a comparative advantage. All these changes would influence both Soviet economic development and Soviet trade. Relatively little can be predicted about the future structure of the Soviet economy and its likely development in the next one to two decades.\*

Because of the inadequacy of our data, it is not possible to characterize the Soviet economy adequately. Nevertheless, some projection of Soviet economic growth is desirable in order to estimate the effects of future growth on trade and technology transfers.

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\*It appears to be extraordinarily difficult for even Soviet economists to understand the nature of their economy because of the inadequacy of the data. For example, in the Samizdat publication by Aleksandr Goltsov and Sergel Ozerov, the distribution of the national income of the Soviet Union produced in Leningrad in late 1971 suggested that the Soviet GNP is perhaps only 17-25% of the U.S. GNP. This calculation was made by developing dollar-rouble exchange rates, by building up the Soviet economy from Soviet agricultural production, the only significant products produced by the Soviet economy which are available for international trade. This had conflicted sharply with other studies, such as one by A. Tarn in Soviet Studies, April 1968, where Soviet industrial output was estimated to be two-thirds of that of the U.S. The analysis of the Soviet economy by two professional Soviet economists has had serious methodological flaws, and as a consequence has not been characterized as a useful contribution to Western understanding of the dimensions of the Soviet economy. It nevertheless emphasizes the difficulty of accurate quantitative characterizations of the Soviet economy. For a detailed discussion of the Samizdat see David Dyker, "A Samizdat View of National Income", in The Soviet Analyst, London, October 4, 1973.

### 13. Soviet Perceptions of the Link Between Politics and Economics

If no linkage is made between the political and economic dimensions of U.S.-Soviet trade, then the commercial aspects of trade are likely to dominate. But if explicit linkages can be developed and exploited, then commercial aspects will become less significant and the overall benefits of trade will become more closely related to general national interests, rather than to individual economic interests.

### 14. Strategic Perspectives

A range of perspectives can be adopted to evaluate trade policy. For example, one can consider U.S.-Soviet trade from the perspective of economic warfare or from the perspective of foreign aid.

We will summarize in the following chapters some of the most significant dimensions of our research on technology transfer problems. In Chapter II, we review some of the organizational aspects of U.S.-Soviet trade, particularly the disparate nature of American and Soviet organizational preferences for conducting trade and technology transfers.

In Chapter III, we consider the Soviet demand for imports in major product categories and preferred countries of origin. We conclude that the Soviet demands for U.S. and other foreign technology is virtually insatiable. Consequently, we decided to characterize Soviet import priorities by conducting a survey between August 1972 and June 1973 of Soviet imports, as reflected in actual purchases or sales agreements.

In Chapter IV, we have reviewed the evidence for characterizing the Soviet process of technology assimilation. We have suggested several models for describing this process. These models were developed with the

assistance of American and foreign businessmen who have participated in the technology transfer process. But empirical work in this field is difficult because of the relatively primitive state of knowledge concerning Soviet decision-making.

In Chapter V, we have reviewed the Soviet export potential. This issue is particularly significant because it suggests the level of trade which the Soviet Union may be able to sustain in the future. If a high level of Soviet exports can be reached, sufficient foreign exchange earnings would be available not only for importing major components of advanced technology, but perhaps also for importing entire systems of technology to be integrated into the Soviet industrial framework.

In Chapter VI, we discuss some major national security issues. Some guidance is offered for future policy concerning technology transfers to the Soviet Union.

We have summarized these conclusions in a separate section at the beginning of the study.

## 15. Methodology

In studying these national security implications, we applied several complementary approaches to elicit sufficient information. Three major efforts were made:

### a. Research from secondary source materials

As a result of the growing liberalization of U.S.-Soviet trade since the mid-1960s, a substantial body of literature and a community of researchers have developed. Considerable literature exists about U.S.-Soviet trade, with an increasing emphasis on the issue of technology transfers to the Soviet Union and other Communist bloc nations.

b. A sales survey

Hudson Institute has surveyed the quantitative and qualitative characteristics of U.S.-Soviet technology transfers, as well as transfers with other industrialized nations, for the period August 1972 through June 1973. This survey covered actual sales and sales agreements between major technology and exporting nations, especially the United States, at a time of intense interest in encouraging trade. The purpose of this effort was to identify the Soviet interest in technology imports, and to deduce technology import priorities from the observed Soviet behavior during this period.

c. Interviews and seminars

Hudson Institute conducted a series of interviews and seminars with American, European and Japanese business executives currently engaged in the sale or financing of technology transfers. This aspect of the study provided an important qualitative input into the characteristics of the problem.

The technology transfer subject proved to be a difficult one to analyze. The subject matter does not lead easily to simple and straightforward conclusions. Moreover, the impact of technology transfers frequently depends upon specific circumstances or a specific scenario, and consequently cannot be easily projected. Nevertheless, the nature of technology transfer problems is emerging with sufficient clarity so that public policy issues can be intelligently discussed. Important uncertainties remain because of limited understanding of the Soviet process of technology assimilation and its associated internal mechanisms for

decision-making. We have proposed several models of the technology assimilation process in the Soviet Union. More research on Soviet decision processes is necessary before truly unambiguous policy conclusions can be reached.

## II. SOME ORGANIZATIONAL ASPECTS OF U.S.-SOVIET TRADE

Alternating between hostility and enthusiasm, the Soviet attitude toward trading with non-Communist states has undergone considerable change since 1917. The current Soviet zeal for trade, particularly with the U.S., surpasses previous levels of enthusiasm. Almost certainly, the Soviet rationale for seeking vastly increased trade with the United States includes complex political, economic and doctrinal aspects. Two of these aspects will be considered here: 1) Soviet preferences concerning the form of future commercial relations, and 2) a review of some recent developments in Soviet industry and agriculture.

### 1. Soviet Preferences in Trading with the U.S.

Foreign trade has always held a pivotal role in Soviet economic growth as a means to achieve economic modernization.\* In practice, however, the Soviets have guarded foreign trade very carefully as an engine of economic growth. In fact, one of the early acts of the Soviet regime on April 2, 1918 was to establish a state monopoly over foreign trade. A leading statement of Soviet doctrine explained the crucial importance of maintaining a state monopoly for foreign trade:\*\*

Mere customs barriers, no matter how prohibitive, cannot save the Soviet economy from the economic penetration of world capital, and without the monopoly of

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\*J. Watstein, "The Role of Foreign Trade in Financing Soviet Modernization," American Journal of Economics and Sociology (July 1970), p. 305.

\*\*D.I. Kutuzov, ed., Vnyeshnaya Torgovlya S.S.S.R. za 10 lyet (The Foreign Trade of the U.S.S.R. for 10 years), Moscow, Narkomtorg S.S.S.R. i R.S.F.R. (People's Commissariat of Trade of the U.S.S.R. and the R.S.F.S.R., 1938) quoted in Watstein, op. cit., p. 306.

foreign trade the Soviet State could not even begin the building of its economy on Socialist principles . . . under conditions of early Soviet economic weakness any rich industrial country could break through the Soviet customs barriers.

By this monopoly, the state could exercise complete control over import licenses. This mechanism is still in existence today, and permits the level and distribution of imports to be totally controlled.\* Except for 1933, the Soviets managed to produce a favorable balance of trade between 1917 and 1945; since World War II, however, the Soviet trade balance has been negative.

The traditional Soviet objective has been to secure sufficient export earnings in order to pay for those imports required for achieving economic autarky. Soviet literature is quite explicit on this point:\*\*

Our exports serve to secure the valuta (foreign exchange) and by means of this valuta we have imported the equipment and the means of production indispensable to heavy industry; thus foreign trade had served and continues to serve as a mighty lever for the accelerated fulfillment of our industrial plan.

....Foreign trade had played a particularly pivotal role in the period of the First Five-Year Plan. The rebuilding of our industry had scored some successes, but in the areas of metals and machinery our industry still limped badly. . . . The imperatives of faster tempos of industrialization, of a creation of high-powered metallurgical industry and of machinebuilding industries in the shortest possible time demanded an expansion of our trade relations with capitalist countries in order to

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\*This fact is underscored by the large changes in the level of Soviet imports in the decade between 1923 and 1932. In 1923 gross imports from the U.S. were only \$1.9 million, but rose to \$24.3 million in 1930, and fell to \$10.3 million in 1932.

\*\*D.D. Mishustin, Sotzialisticheskaya Monopoliya Vnyeshney Torgovli S.S.S.R. (The Socialist Monopoly of Foreign Trade in the U.S.S.R.), Moscow, International Book Publishing Company, 1938, quoted in Watstein, op. cit., pp. 308-9.

utilize their advanced technology for the quickest realization of our goals. This posed the problem of not squandering the precious valuta on items of secondary importance but on importing le dernier cri of capitalist technology--equipment of the very latest design and construction in order to free the country from the need of importing this machinery and equipment once the goal had been reached.

As a result, the U.S.S.R. maintained relatively short-term trade arrangements with non-Communist states in the 1920s and 1930s. American businessmen became accustomed to large orders in one year, only to face drastic curtailments one or two years later as soon as Soviet production could take over as a source of supply.\*

Recent evidence from government and commercial contacts suggests that Russia is changing its attitude on the preferable form of trade with non-Communist states. Soviet traders now seek to negotiate long-term arrangements which are financed at preferential rates.

A recent example is the Soviet negotiations for West German chemical exports. Today West Germany is the leading supplier of chemicals to Russia, exceeding the nearest competitors--Japan, Italy and France--by more than a factor of two. In these arrangements, the Soviets had been asking for 30-year loans financed at not more than 6 percent interest.\*\* These terms cannot be provided on a commercial basis, and thus government involvement is required in the financing of these transactions.

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\*For example, the State of Texas had the largest share of U.S. Soviet trade in 1927-28, but by 1930, Soviet purchases in Texas were halved as a result of the production of cotton in Turkestan. See "Who is Getting Those Russian Orders?" Business Week, February 19, 1930, pp. 35-6.

\*\*"U.S.S.R. Lures Western Chemical Firms," Chemical and Engineering News, October 12, 1970, pp. 22-3.

Whatever hypothesis is accepted concerning the Soviet interests in American trade, it is clear that Soviet doctrine still imposes limits on the manner in which this trade will be conducted. Recently, an international lawyer who specializes in U.S.-Soviet commercial relations described some of these doctrinal limits:\*

Marx and Lenin said foreigners, let alone foreign capitalists, cannot invest in a Communist country. That's exploitation. All production must be state owned. So it is futile to talk about owning an oil refinery or gasification plant in Murmansk. But it may not be impossible to build a plant under an agreement, transfer ownership to the appropriate Soviet authority, and make a leaseback type of agreement to be the effective operator in conjunction with the Soviet authority. That doesn't offend the ideology.

You can't acquire equity in a Soviet firm or sit on a board of directors. But there is nothing to prevent you from negotiating an elaborate contract which provides for a management committee and a technical committee responsible for designing, building and operating a plant that would supply a need in the Soviet market and manufacture for export.

You can't have dividends or profit participations. What you can have is a royalty payment for patents or know-how, engineering fees, management fees, interest, selling commissions. None of this is precluded by Marx and Lenin. There is nothing to prevent you from incorporating a company outside the U.S.S.R. where the equity is held 50-50 by an American company and a Soviet enterprise. Such trans-ideological corporations already exist.

Since these doctrinal impediments are both numerous and very divergent from traditional Western business practices, it is clear that special organizational structures will be necessary if Western businesses are to participate in the Soviet market.

As a result of the extensive discussions between American and Soviet officials since the Nixon-Brezhnev talks in May 1972, we can examine some

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\*An interview with Samuel Pizar quoted in George Meiloon, "Going into Partnership With Ivan," Wall Street Journal, March 29, 1973.

of the Soviet preferences for the form of substantial U.S.-Soviet trade. Mikhail L. Misnik, the Deputy Chairman of the State Planning Committee, emphasized in a press conference, held on May 29, the last day of President Nixon's visit, that the Soviets think the classical trade practices are unworkable. He showed a strong Soviet preference for a sophisticated form of barter in order to provide the U.S.S.R. with sufficient technology for their development. Since Soviet currency is not convertible, the financing of these arrangements would seem to be limited to some form of barter.

Misnik stated:\*

It is about time that we move beyond the Stone Age practice of, say, bartering a sheep for half a camel.... In those terms it is unlikely that our two countries would ever achieve a high volume of trade. But if we advance beyond that stage into large-scale arrangements in which the U.S. would provide plant and equipment and we would pay with raw materials and the end products of such plants, then the possibilities are indeed immense.

This represents a major policy shift in the Soviet attempts to acquire foreign technology. In Soviet terms, their technique is described as "a joint venture." In response, Peter Flanigan, the Executive Director of the White House Council on International Economic Policy, recently testified about his understanding of a U.S.-Soviet "joint venture":\*\*

A "joint venture" in our sense of Western equity in domestic Soviet enterprises is an anathema to the Soviets and they have made no bones about it. What the Soviets are interested in when they talk about Western participation in projects in the U.S.S.R. is the export of Western equipment, capital and know-how on credit with repayment in the product produced by the installation or project in

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\*T. Shabad, "Soviet Holds Out Big Prospects in Trade," The New York Times, May 30, 1972, p. 19.

\*\*Testimony of Honorable Peter M. Flanigan, Multinational Corporations Hearings before The Subcommittee on International Trade of The Committee on Finance, U.S. Senate, 93rd Congress, 1st Session, pp. 92-3.

question. Western participation in building the installation and putting it into operation is accepted, but no further Western participation is permitted. The cooperation deals concluded by the Japanese with the U.S.S.R. to expand the output of timber and wood chips and to develop the part of Vrangeli in the Soviet Far East are essentially long-term turn-key projects, as was the Soviet-Italian agreement to build the Flat plant.

The Soviet proposals to develop various raw material resources with Western capital--gas, oil, timber, metals, etc.--are of the same variety. They are distinguished from those concluded in the past only by the significantly larger sums of Western capital that will be required. As you know, several U.S. firms are discussing with their Soviet counterparts proposals involving natural gas and petroleum.

To date, few U.S.-Soviet cooperative deals have been concluded and these fall mainly in the consumer or tourist category--the recent Pepsico deal and several involving U.S. credit card and auto rental companies.

Historically, the Soviet Union showed a preference for other means of acquiring Western technology, such as through licensing, imports of equipment, scientific and technical exchanges, or industrial espionage. These methods are still important. Recent examples include the General Electric licensing agreement, the strong Soviet interest in scientific exchanges shown in the Conference on Security and Cooperation in Europe (CSCE), and the expulsion of 105 Soviet industrial espionage agents from Britain several years ago. These approaches are likely to be less important quantitatively, however, if statutory obstacles to U.S.-Soviet trade can be removed.\*

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\*The Soviets have cited three legal impediments to U.S.-Soviet trade, the lack of Most-Favored Nation tariff treatment, the lack of appropriate export financing, and the removal of restrictions on Soviet vessels in U.S. ports. The New York Times, op. cit., p. 19. Only the latter impediment appears to be on its way to resolution. The former are jeopardized by the widely supported "Jackson Amendment" to the pending Trade Reform Act of 1973 which would prohibit MFN and government-backed export financing if the Soviets maintain substantial barriers to emigration. See Robert F. Morison, "Gibson Says U.S.-Soviet Trade Shipping Problems Resolved," Journal of Commerce, June 5, 1972.

Although joint ventures are not a recent innovation, the Soviets have rarely applied the concept to production ventures. Thirty joint ventures have been undertaken by the U.S.S.R. with Western firms in recent years, and all but three of these are joint marketing and shipping ventures. The three production ventures involve mining equipment, numerically-controlled machine tools and motor vehicles undertaken as projects with West European and Japanese firms.\* None of these joint ventures have approached the scale of the projected multi-billion dollar Occidental Petroleum venture, or have engendered the ebullient Soviet press releases surrounding the Occidental Petroleum proposal.

This form of trade relations has apparently aroused major Soviet expectations. Traditionally, the Soviet Union has minimized the use of organizational and institutional change to improve the efficiency of their economic system. They have opposed direct investment in the U.S.S.R. which might prove to be unsettling. Rather, they have relied on the infusion of advanced technology, without direct investment. But the grave difficulties which the Soviet leadership has encountered in transforming laboratory processes into commercial production has brought about a reorganization of their industrial structure. As announced in March 1973, the industrial structure has been somewhat decentralized and now at least mimics the Western practice of integrating R&D within major companies in each branch of industry. But unlike the Western system, many of the organizational pressures for economic efficiency are mostly absent in the U.S.S.R. Without a suitable proxy for market behavior, the Soviet Union is likely to

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\*Testimony of Peter M. Flanigan, op. cit., p. 93.

be limited in the extent to which it can integrate infusions of sophisticated Western technology.

## 2. Recent Developments In Soviet Industry and Agriculture

Many Americans perceive that enhanced U.S.-Soviet trade constitutes an important element of detente. This view coincides well with the need within the Soviet economy system to increase its output of goods and services.

Along with the announcement of the reorganization of Soviet industry, the Soviets have also revealed major failures in their industrial establishment. A recent article in Pravda by Benjamin Dymshits, the Chairman of the State Committee for Material and Technical Supplies, cited somewhat illustrative examples:\*

1. Misallocation of specialized steel production (nuts, screws, and bolts) to high cost non-specialized plants resulted in a metal production loss estimated at 100,000 tons annually.
2. Alluding to an apparent persistence of simple-minded "tonnage" planning targets, two major steel plants have produced sheet steel and rolled stock of a greater thickness and diameter than prescribed, causing additional waste.
3. The Ministry of Heavy Machine Building reported that many of their plants continue to cut obsolete types of gears, while other plants produce modern types wasting 50,000 tons of cast and rolled metal per year.
4. Inefficient tool-cutting machinery has resulted in the loss of 25% of the metal used in the industry through waste fillings of various kinds.
5. Despite the high Soviet reputation for the production of turbines and generators, energy production in the Soviet Union operates at a low level of efficiency

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\*Pravda, March 28, 1973.

due to inadequate thermal control and automation devices, and the inadequate use of exhaust gases.

6. Several other industries were singled out as being grossly inefficient due to what was described as inadequate transportation and ineffective programs for end use. Those industries include cement, glass, timber, and paper.

In agriculture, Soviet difficulties are well known, but the organizational response is still in a state of flux. While bad weather has been a complicated factor, it is only one component of a larger problem.\* The seriousness of agricultural problems led to the dismissal of the Minister of Agriculture and his deputy, and these problems were put under the supervision of the Politburo under Polyanski.

Agricultural reorganization seems to have met the most ideological resistance. Polyanski argued for separating agricultural and industrial management from Party control, but this position appears to be difficult to maintain within the Politburo. If this policy is adopted, it may mean a rather broad change in Soviet agriculture to permit greater absorption of American agricultural technology. But if the U.S.S.R. is to place major emphasis on livestock production, it will require a top-to-bottom reorganization of Soviet agriculture, and it would seem that significant private ownership of agricultural output will be required.

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\*An essay in Izvestiya on 9 February 1973 issued a strong attack on those who blame agricultural failures on the weather or inadequate numbers of trained personnel.

## III. THE SOVIET DEMAND FOR IMPORTS

In analyzing large-scale technology transfers, a major concern is the distribution and the level of technology imports by the Soviet Union in the future. Many factors may motivate particular Soviet technology imports. In some cases, a technology import can reduce the cost of an existing process through the infusion of more efficient technology. In other cases, bottlenecks can be eliminated in the production process where imported technology can fill a gap not easily met by domestic technology. Furthermore, the efficiency of the Soviet economy in allocating resources can be improved. Imported technology can augment existing but inadequate advanced technology resources.

If the historical Soviet model of economic growth were sustained in a future period of large-scale imports of technology, a significant shift could occur in Soviet trade and economic growth. Campbell has identified three key elements in the Soviet approach to growth: the mobilization of resources, a focus on strategic links within the economy, and the "routinization" of the growth process.\* In this model, the rate of growth is determined by two counteracting forces: the "drag" of a low growth in labor input vs. the growth in capital stock. The rate of growth of capital stock is dependent in turn on the increased role of investments and the use of additional capital to compensate for the drag of labor input.

This model is effective as long as the substitution of capital for labor is not impeded in order to add to the level of output.

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\*Robert W. Campbell, The Soviet Type Economies: Performance and Evolution, Houghton-Mifflin Company, New York, 1974, pp. 142-156.

In the past decade the Soviets have run into considerable difficulties. Campbell has noted that underutilized or unutilized labor must be mobilized in order to continue the growth of labor inputs. At the same time, capital stock growth requires a continuous rise in the share of national income devoted to investment. Limits may have been reached in both cases, as now expressed in a shift of focus for Soviet economic planning. Campbell has described this change:

When rates of growth began to decline all over the Communist world in the early 1960's, a number of East European economists made a diagnosis similar to that outlined above. They characterized the strategy which they had been following as one of "extensive growth," and were much worried by the implications of trying to sustain growth by continuing that strategy. It was a realization that aroused their interest in reform as a way to shift to a strategy of "intensive growth" that would be based on more productivity increases and less input increases. This would be partly a matter of adopting new patterns of resource allocation, with less emphasis on investment. It was seen as a way of backing out of the trap of channeling all the increments into capital, a policy that prevented them from increasing consumption which might have helped improve the quality of labor input through better incentives to offset its slow quantitative growth. But any shift to an intensive growth strategy would also require fundamental changes in the functioning of its system. To achieve the productivity increases that was to substitute for the massive infusion of capital would seem to require very great changes in the system of incentives and decision-making.

In the current five-year plan, the Soviet Union is shifting from an intensive growth strategy to a strategy that emphasizes productivity as a source of growth, rather than investment.\*\*

In order to project the future pattern of Soviet technical imports, we have surveyed recent sales and sales agreements, as well as licensing, technical and industrial arrangements with the Soviet Union in the period

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\*Campbell, Ibid., p. 160.

\*\*Campbell, Ibid., p. 161.

between August 1972 and June 1973. This survey included the United States and other non-Communist countries that are able to export advanced technology--specifically the United Kingdom, West Germany, France, Italy and several other industrial nations. This compilation was derived from industry sources, trade publications, U.S. government publications and the press. While the list of sales and agreements is not exhaustive, it represents a preponderant fraction of the agreements and sales concluded during this period. Consequently, it provides a useful insight into the character of recent Soviet demands for technology imports.

A list of Soviet purchases, itemized by country and volume, is shown in Appendix A, and a list of agreements for industrial and scientific cooperation is shown in Appendix B.

It is interesting to note the distribution of actual sales in this period. There is little evidence to indicate that the U.S. is in fact a favored trading partner of the Soviet Union, as compared to other major countries capable of exporting advanced technology. Moreover, U.S. sales to the Soviet Union are not dominated by large dollar sales.

The only trade category in which the United States is unambiguously in first place by volume of sales is electrical machinery and apparatus. Even here, the dollar volume is not substantial. The U.S. leads among exporters with approximately \$21 million in sales, followed by France with \$10.7 million in sales during this period.

The popular idea that the United States will become the dominant trading partner of the Soviet Union does not seem to be supported by the evidence of early Soviet purchases of Western technology. Rather, the Soviets seem to consider more traditional commercial considerations of

obtaining the best product for the best price. We may similarly cast doubt on the idea that the Russians prefer the U.S. as a trading partner because the United States is the only country that is a match for Soviet import demands in terms of size and technical sophistication. In fact, the larger sales were made by West Germany.

DISTRIBUTION OF NUMBER OF SALES AT CERTAIN SIZES BY COUNTRY

U.S.	Germany	France	U.K.	Japan	VOLUME OF SALE IN \$ MIL.
2	2	0	14	3	less than 1
7	5	8	13	2	1-5
2	3	4	2	4	5-10
6	1	3	3	2	10-20
6	3	6	0	1	20-50
1	1	1	1	0	50-100
0	2	0	0	0	100+

The table illustrates the geographic distribution and volume of sales between the five major Western technology exporters and the Soviet Union. While the United States was a relative late-comer to trade with the Soviet Union, there is no discernible pattern of preference in favor of the U.S.\* One plausible hypothesis might suggest that the Soviets

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\*Information contained in this chart excludes the recent grain sales to the Soviet Union.

would seek to purchase their most urgent domestic requirements for Western technology. In reviewing the list of commodities traded, however, we are not overwhelmed by the nature of the sales. They cover a wide range of mostly mundane forms of technology, rather than relatively exotic technology.

The Soviet Union may have substantial institutional difficulties in coordinating its import policies. They are unused to Western markets in detail, and the list of sales appears to reflect the priorities established within individual industries, rather than a coordinated and centralized campaign to secure high-priority imports of foreign technology.

The second category of Soviet arrangements to import foreign technology has been a series of agreements with Western countries. These agreements fall into two categories--industrial cooperation and scientific-technical cooperation.

The industrial cooperation agreements generally involve licensing, the supply of plants or production lines, including the supply of plants or equipment for the exploitation of natural resources, and the supply of technology. Payments are to be: (1) the resulting product, (2) coproduction, payment in goods other than the resultant product, or payment by unknown means.

The scientific-technical cooperation is carried out in the following categories: (1) joint research and development, (2) exchange of information, test results, licenses, etc., (3) exchange of personnel, (4) general scientific-technological cooperation. Ultimately, some of these scientific-technological cooperation agreements will emerge into industrial cooperation and perhaps outright sales of technology and products. The

agreements which could be identified between August 1972 and June 1973 are listed in Appendix B.

The industrial cooperation agreements tend to be far larger than the outright sales. For example, where barter payment is feasible, such as the El Paso-Occidental natural gas deal, it is estimated that the deal is valued at \$10 billion. The barter arrangements tend to take place over a substantial period of time ranging from five to twenty-five years. A conspicuous shift in the distribution of agreements among nations has apparently taken place, with the U.S. dominating the scene. In fact, the Federal Republic of Germany made no identifiable barter arrangements during the period.

The pattern of sales and trade agreements which has emerged over the past two years is a picture of the Soviet Union with virtually insatiable demands on the U.S. economy. These demands could not, in most circumstances, be fulfilled by existing U.S. productive capacity.

The categories in which the Soviet demands for technology are most apparent are:

1. Long-Term Supplies of Agricultural Products

A series of decisions concerning Soviet agriculture, particularly the decision to shift the Soviet protein source from food grains to livestock, virtually guarantees that the Soviet Union will be a continuing major purchaser of feed grains. The U.S. has a monopoly on feed grains, particularly soy beans, that is more extensive than the domination of oil production by the Arab states. Thus, the Soviet dependence on imported agricultural products is not subject to great change: the Soviets will be compelled to import agricultural products from the United

States if they are to maintain the agricultural program which their five-year plan requires.

## 2. Automotive Manufacturing Technology

The Soviet economy has shown a poor performance in the manufacture of civilian automotive transportation. Consequently, the Soviets are attempting to import an entire automotive manufacturing system. If this enterprise proves successful, it is likely to serve as the prototype for importing other technologies important to Soviet development. It is not yet clear how the Soviets will employ the output of their automotive manufacturing facilities when they are in full production. Indeed, there is considerable dispute among U.S. observers how the vast output of these facilities will be employed, given the absence of appropriate infrastructure elements (e.g., a large road network, service facilities, and an interest in maintenance).

## 3. Computer and Systems Technology

The Soviets face a substantial disadvantage in their managerial and decision-making skills and techniques. They are seeking to import a system of computer-supported management that will enhance the perennially lagging efficiency of their centrally-planned civilian economy. This approach appears to be piecemeal: individual industries are importing computers and, occasionally, systems-integration assistance. Unlike other aspects of Soviet technology imports, this appears to have a high priority, as shown by the Soviet willingness to pay cash on delivery.

#### 4. Oil and Gas Technology

The most substantial potential source of export earnings for the Soviet Union lies in extractive industries. This is particularly true for natural gas. Russia has already decided to restrict foreign exploitation and sale of its petroleum reserves because of the high level of COMECON demands.

Soviet natural gas reserves, however, are vastly in excess of domestic and COMECON requirements. As a result, the Soviets wish to import technology for exploiting these reserves. Soviet oil production technology is also substantially inferior to that employed in the West, and U.S. technology may be imported. The Soviets may possibly face an energy shortage in the early 1980s.

#### 5. Earth-Moving and Timber Equipment

The Soviet ability to exploit its mineral and timber resources is substantially limited by a lack of suitable equipment and an appropriate infrastructure. As a result, efficient U.S., European, and Japanese earth-moving, timber-handling and processing equipment has become an important Soviet import priority. Timber exploitation appears to be dependent on implementing some coproduction schemes.

#### 6. Automated Feed Lots and Agricultural Technology

The Soviet effort to enhance its agricultural output and composition has enhanced the Soviet interest in importing U.S. agricultural technology on a wholesale basis. U.S. feed-lot technology has proved to be an efficient means of producing livestock, while American food-processing technology has become an efficient bridge between agricultural producers

and consumers. Lagging Soviet capabilities in both areas have resulted in an intense interest to import this technology.

#### 7. Associated Infrastructures

Virtually all elements of the Soviet import "shopping list" require a substantial investment in infrastructure, if the investment is to be efficient. Thus far, only in the computer and management systems fields have the Soviets shown increasing sensitivity to the infrastructure requirements of their technology imports. Infrastructure spending is likely to be broadened as efforts are made to integrate technology into the economy.

#### Commercial Sales

It is evident that the Soviet Union does not follow an overall "Buy American" policy in its foreign trade. Sector by sector, often the smallest volume of purchases was from the United States (as far as this can be established from the incomplete information here). In some commodities, purchases from the U.S. are conspicuously absent.

Despite the three U.S. sales in mineral fuels, the United States was far outstripped by France in this category. France's sales totalled \$149.2 million; the U.S. sales totalled \$27 million.

In chemicals, the U.S. was in seventh place (not counting Switzerland, for which no volume is known), with a volume of \$3.6 million, well behind Germany and France, who led with a volume of \$54.3 million and \$56.5 million respectively.

The U.S. lagged in manufactures, too, with a volume of \$22.3 million, as opposed to France \$82.7 million, Germany \$96.12 million, and the U.K. \$142.63 million.

Depending on the size of the U.S. sale in manufactured articles, for which volume is unknown, the United States may not be so far behind. Yet it seems unlikely that the U.S. would exceed the other countries in this sector. Much of the U.S. lag in manufactures can be attributed to a conspicuous absence of iron and steel sales.

Electric machinery and apparatus is the sole category, aside from grain sales, in which the United States is clearly in first place. The U.S. leads with a volume of \$20.4 million, followed by France \$10.7 million, and the U.K. \$4.5 million. In transport equipment the U.S. shares the lead with West Germany. It is impossible to establish who is number one, since Germany totals \$354.0 million for all its sales, and the U.S. totals \$244.4 million for two-thirds of its sales. Ninety-eight percent of the German sales and 93 percent of the U.S. sales of transport equipment are in the automotive industry. Japan, in third place with a volume of \$53.6 million, sold mostly ships.

This analysis shows that the U.S.S.R. does not give preference to the purchase of goods from America, as might be expected if their foreign trade were motivated mostly by political considerations, especially détente with the United States. There is some evidence, albeit scanty, that the Soviets are guided by considerations of comparative advantage and of traditional admiration for the products of certain countries. Examples are the purchase of wood products from Finland, dredgers from the Netherlands, and automotive purchases from the U.S. and Germany.

It has been said that the Soviet Union is particularly anxious to trade with the U.S. because only the U.S. can sell large systems. In the list of sales compiled here, there are no large sales made by the

U.S. which could not just as well have been made by other Western countries. The reason is not necessarily that the Soviet Union is not shopping specifically in the United States for certain large package deals. They may very well be looking for a special trade in the U.S. and have failed to find any company willing to sell outright what they want, as our analysis of these agreements seem to indicate.

There is no evidence that the U.S. has sold uniquely large systems to the Soviet Union. We find that the distribution of sales of a given size varies from country to country, as shown in the Table on page 3-4.

The U.K., with its multitude of small sales, differs most markedly from the general pattern of sales by the other countries. The two largest sales were made by Germany, not the U.S. as one might have expected.

It has been said that the Soviet Union prefers dealing with firms with which they have had prior experience, and with which they are well acquainted. As the Soviet Union began to develop trade with the West on a large scale during the past decade, they did look first to their old Western business acquaintances. The scope of our survey does not cover a long enough period to comment much further; however, the list of sales presented here does show that the U.S.S.R. has dealt repeatedly with several companies.

The extent of Soviet diversification among different countries and different firms in the automotive industry is surprising, considering that most of the purchases were for the Kama River truck plant. With the exception of two purchases from Germany's Liebherr Verzahntechnik, the Kama River project is made up of many purchases, no larger than \$30 million each, and many smaller purchases from various countries and many firms.

From the U.S., Combustion Engineering and Se-Kast supplied moulding machines; Ingersoll Rand sold machine tools and automatic lines for engine cylinder-block production; Gleason supplied rear-axle production equipment; and Carborundum provided shot-blasting machines.

France's Sonocom supplied automatic presses and Renault sold a cylinder-coating factory.

Britain's Haden Carrier supplied pretreatment and painting lines; Moon Brothers produced a vehicle silencer production line, component assembly machines and equipment for testing tanks; Federal Welder & Machine Company supplied an airbrake cylinder production line, and DYMO sold machine tools for a low-pressure diecasting foundry. Britain's Girling was made the main contractor for an automatic line for brake shoes.

One troublesome exception to the apparent rule of diversification in the Kama River project are the two sales by Germany's Liebherr Verzahn-technik, which are far larger than all the others. Were it not for these two arrangements, it would seem that the U.S.S.R. seeks to spread out its purchases for Kama, so that they were not dependent on any one supplier, which might be too risky politically and economically for the Soviet Union's top-priority industrial project.

A closer look at the large Liebherr Verzahntechnik sale shows that this firm was not the sole supplier, but rather the coordinator through which subcontracts were given to 41 German, four British, one Swiss and one Italian companies. This may be an example of the type of package arrangement that the Soviets are looking for.

It has also been said that Liebherr Verzahntechnik underbid other firms for the contract, and offered unusually good credit. Moreover,

because of the structure of the Soviet economy, it is very convenient for them to buy package deals. Furthermore, in their trade with the West, the Soviets seek to obtain the most goods for the least money. Thus, the mixture of large and small diversified contracts in the automotive sector probably resulted from conflicting tendencies to diversify for security, and negotiate large arrangements for convenience. The size and diversification of the sales may be determined by the availability of bids at various sizes, and by which Soviet organization conducts the negotiations.

The Soviet purchases of American grain, which were substantially subsidized by the U.S. Government, illustrates that the Soviets will not pass up a good deal. The low level of trade with the U.S. in certain sectors and a high level in others reinforces the view that the Soviet Union is guided primarily by rational economic calculations. Any political motivation in Soviet purchases is shown by a tendency to diversify purchases among different suppliers, as long as no individual supplier offers a superior arrangement.

#### Agreements for the Transfer of Technology<sup>\*</sup>

The data for analyzing Soviet agreements was compiled from Hudson Institute's survey of U.S.-Soviet commercial relations in the August 1972-June 1973 period. The same guidelines for sales have been used to analyze these agreements. The following charts show the number of agreements signed by each country in each major category of commodities identified

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<sup>\*</sup>A useful review of U.S.-Soviet technology exchange, particularly that of policy issues relating to the exchange of scientific information, is contained in James C. DeHaven, Technology Exchange: Import Possibilities from the U.S.S.R., The RAND Corporation (R-1414-ARPA), April, 1974.

in our survey. If a single agreement was signed jointly by firms in two countries, then both countries are listed, but the arrangement is portrayed in the charts as one agreement.

The United States is in first place in terms of the number of agreements with the Soviet Union, with U.S. firms holding 24 agreements. Germany follows with 13 agreements, one of these being jointly held with Belgium. Britain, France, Italy, Belgium, Japan and the Netherlands are behind both the U.S. and Germany, with 6, 3, 3, 3, one and one agreements respectively.

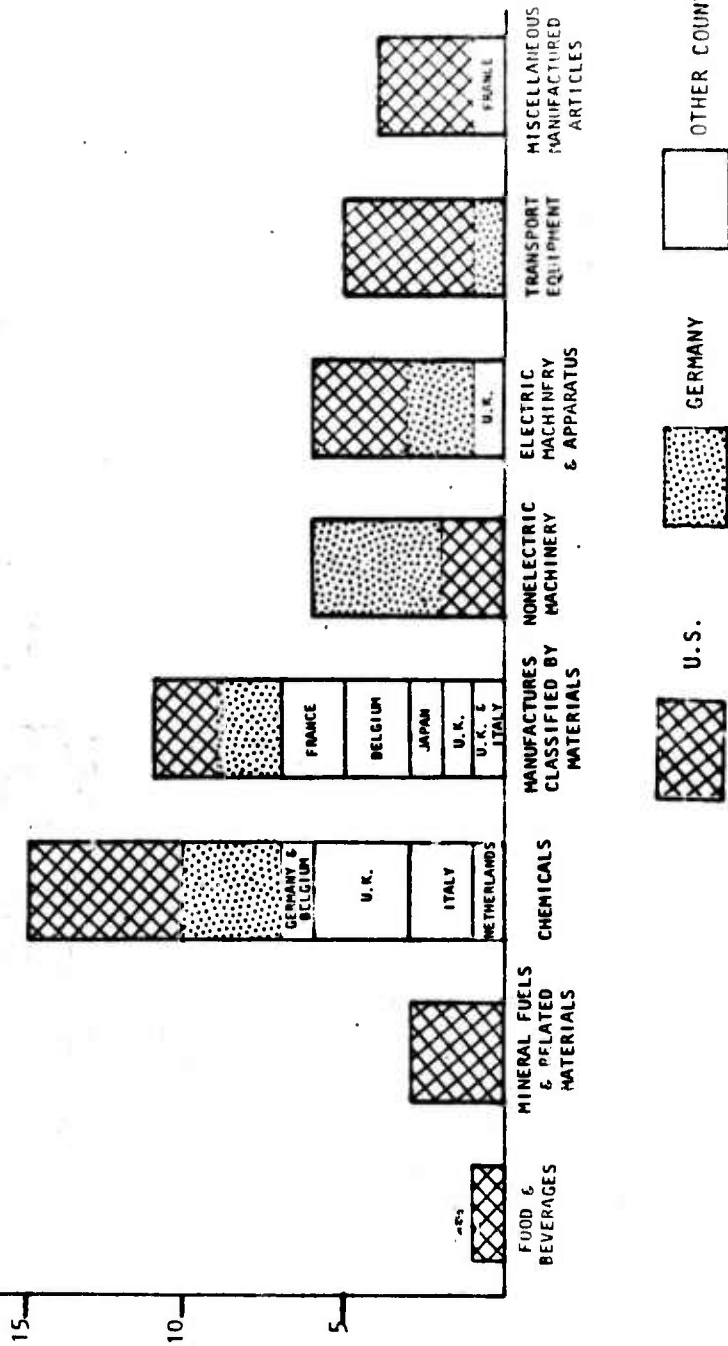
United States and German firms signed a preponderant proportion of the agreements with the U.S.S.R. in all but the two commodity categories having the largest number of agreements: chemicals and manufactures. The greater incidence of other European signatories in these two categories may be a function of the greater number of agreements. It may also show the ability of a given country to supply specific Soviet needs.

The overall preponderance of agreements signed by the United States and West Germany may reflect a basic difference in the way these two countries and others conduct business with the U.S.S.R.. U.S. and West German leaders may also perceive an integral connection between economic cooperation and détente. However, an analysis of the types of agreements made with the U.S.S.R. shows a basic difference in approach between the U.S. and Germany.

The agreements fall into two main categories, with very little overlap: industrial cooperation, or cooperation in the production of specific products; and scientific-technological cooperation, or cooperation in the realm of ideas and information. Some agreements have elements of both types.

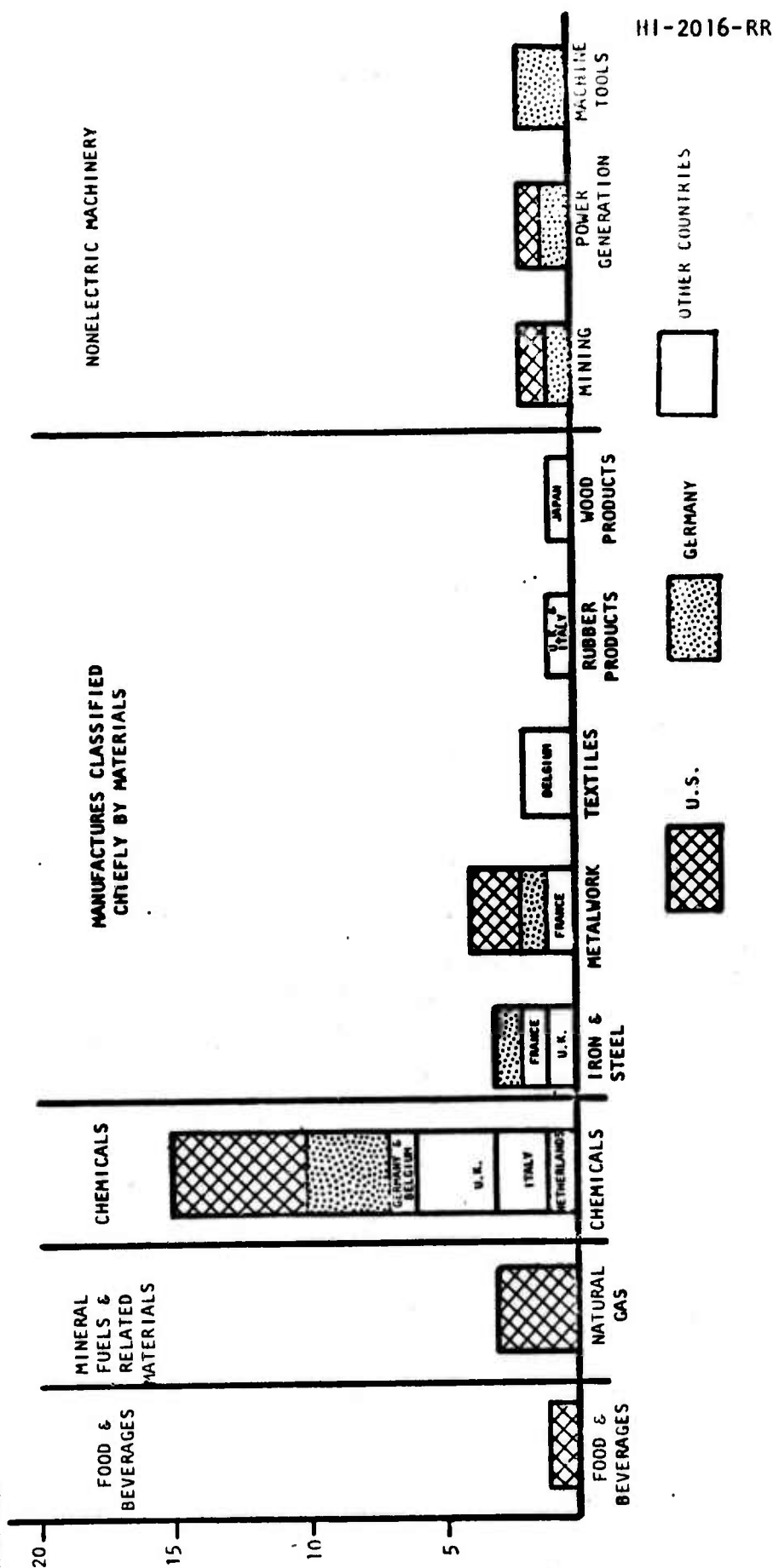
NO. OF  
AGREEMENTS

U.S., GERMAN AND OTHER WESTERN EUROPEAN AND JAPANESE AGREEMENTS  
WITH THE U.S.S.R. BY COMMODITY- AUGUST 1972 - JUNE 1973: TOTALS



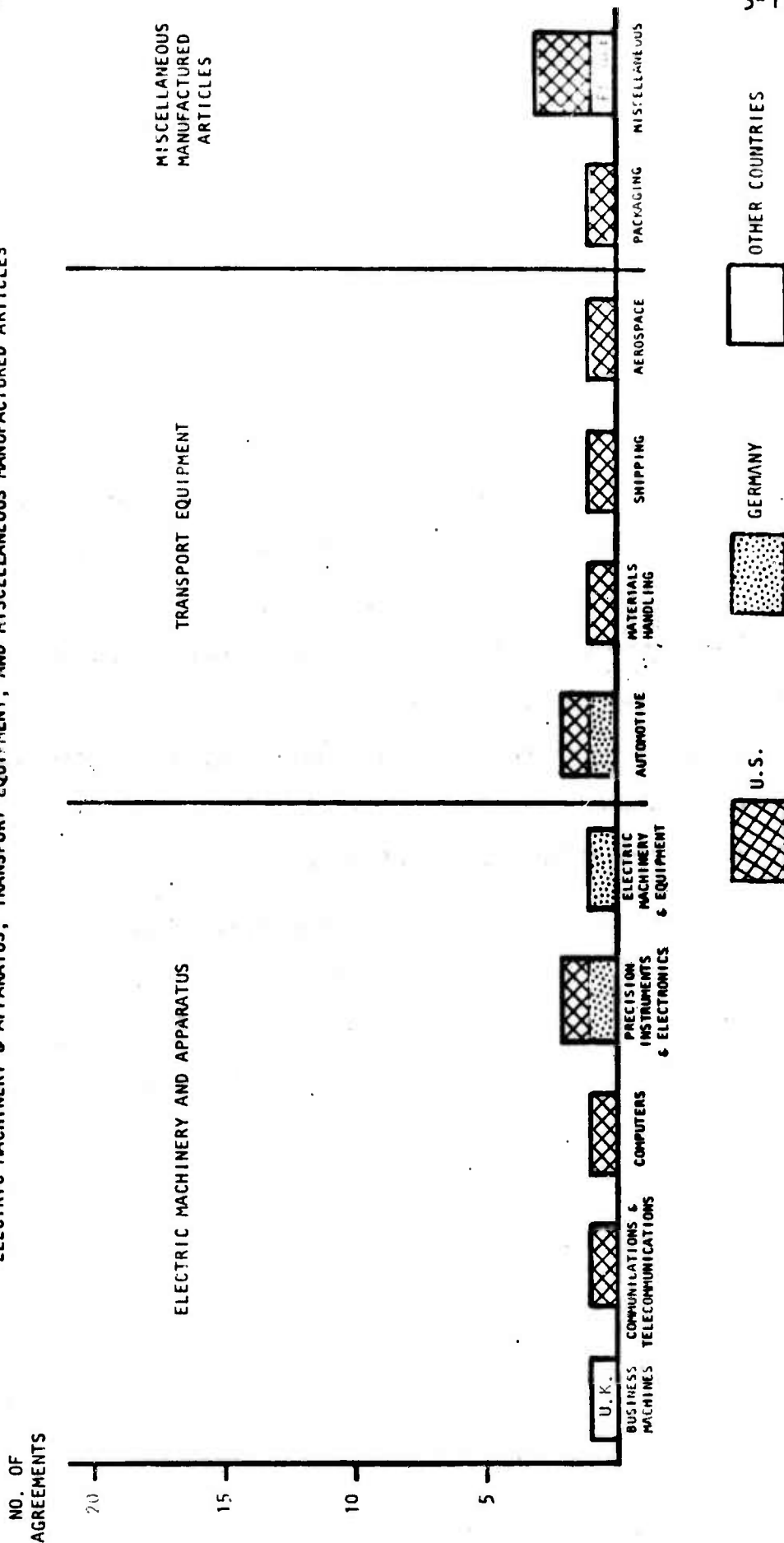
U.S., GERMAN, AND OTHER WESTERN EUROPEAN AND JAPANESE AGREEMENTS WITH THE U.S.S.R.  
AUGUST 1972 - JUNE 1973: FOOD & BEVERAGES, MINERAL FUELS, CHEMICALS, MANUFACTURES AND NONELECTRIC MACHINERY

NO. OF  
AGREEMENTS



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U.S., GERMAN, AND OTHER WESTERN EUROPEAN AND JAPANESE AGREEMENTS  
WITH THE U.S.R. AUGUST 1972 - JUNE 1973:  
ELECTRIC MACHINERY & APPARATUS, TRANSPORT EQUIPMENT, AND MISCELLANEOUS MANUFACTURED ARTICLES



Within the main categories of industrial and scientific-technological cooperation, subcategories were identified by listing all the provisions of the agreements, according to the information collected by the Hudson Institute, and grouping together provisions that had related implications.

The following subcategories describe the varieties of industrial cooperation agreements:

1. Licensing, supply of plants or production lines, including supply for the exploitation of natural resources, and sale of technology with payment in the resulting products;
2. Licensing, supply of plants, technology, etc., with payment in goods other than the resulting products;
3. Licensing, supply of plants, technology, etc., with the method of payment unknown;
4. Co-production and specialization.

The first two sub-categories are both kinds of barter deals, but have been listed separately because of the implicit credit element in the stipulations for payment in the resulting products. The third sub-category was required by the scantiness of information about some of the agreements.

In co-production, the parties cooperate in production of a final product by specializing in components, with the technology coming from one of the parties, from joint R&D, or from each party individually. In specialization, each party specializes within a range of final products which, when exchanged, complete the line of products offered by each partner in their respective markets.

Scientific-technological cooperation can be broken down into the following sub-categories: 1) joint R&D, 2) exchange of information, test results, licenses, etc., and 3) an exchange of personnel. Sometimes agreements call for technological and scientific cooperation without further specifying its extent or character. Hence, a fourth sub-category was added: general scientific-technological cooperation. Several of the agreements on scientific-technological cooperation declared that specific projects were to be planned or that industrial cooperation was the eventual goal. Such stipulations are listed under a fifth sub-category: possible industrial cooperation. A given agreement on scientific-technological cooperation could fall into all of these five sub-categories, since they are not mutually exclusive.

We listed in the chart on page 3-15 the agreements analyzed, the non-Soviet signatory, and the types of cooperation which the agreements call for. Some agreements are very broad, covering several varieties of industrial and scientific-technological cooperation. Since the categories of cooperation are not mutually exclusive, it was possible to list some agreements under several categories.

From the limited information available, we note there appears to be at least some correlation between the size of agreements with the Soviet Union and the method of payment. Most of the deals which called for barter payment were considerably larger than the sales discussed above. The El Paso-Occidental natural gas agreement is valued at \$10 billion, the Tenneco-Texas Eastern Transmission-Brown & Root natural gas deal at \$900 million, the Occidental fertilizer plant at \$8 billion over 20 years, one of the Occidental metal finishing agreements at

\$120 million, another Occidental metal finishing arrangement at \$80 million, and the Japanese wood chip processing deal at \$100 million. The Satara bicycle and motorcycle equipment agreement, valued at \$18-19 million, is the only one known to be under \$80 million. Aside from the grain sales, only two sales were known to be over \$80 million. No information was available, however, on the volume of the Pepsi arrangement, the advertising contract, Italy's ENI chemical plant, or the AKZO NV yarn, fibers, chemicals and pharmaceuticals agreement.

It is likely that in order to make such large agreements, the Soviet Union insists on barter payment because of its shortage of hard currency. There is a prevalent feeling among U.S. analysts that the Soviet Union has almost no goods to offer in payment, instead of hard currency. The nature of the barter deals bears this out.

Several of the barter arrangements call for payment for plants, equipment to exploit natural resources, and technology, in the resulting products. This has the advantage for the Soviet Union of assuring a continuing commitment by the supplier to the quality of the equipment and know-how being supplied. Such payment also implies the extension of credit to the Soviet Union and a considerable risk taken by the supplier. This is especially true of the natural gas transactions, which involve a sizable initial investment with a dubious return, since it is doubtful whether the Soviet Union will be able to drill deep enough for the gas, and transport it at a reasonable cost.

Other barter deals call for payment in goods other than the resulting products--mostly in raw materials. This is to be expected in view

of a UNESCO study of East-West trade. It found that Western partners interested in obtaining the raw materials of the East voiced relatively few complaints about barter payment, but those who agreed merely to facilitate signing a cooperation contract were often dissatisfied because of quality control problems, late deliveries, and marketing problems.\* Indeed, the one barter deal which calls for payment in goods which are neither raw materials nor resulting products--the Pepsi-vodka barter deal--has encountered problems in marketing, setting the volume of the deal, etc.

Two of the agreements call for payment in both resulting products and raw materials. This may reflect further difficulties with barter payment: a reluctance by the supplier to accept payment totally in result products because of the credit element, and problems of quality control, combined with Soviet unwillingness to pay the entire cost in raw materials. The Soviet Union has little difficulty selling raw materials abroad for hard currency and therefore may be reluctant to use them for barter.

The relatively large number of U.S. barter arrangements supports the Soviet claim that the U.S. has the potential to make large agreements which would be prohibitive for most other countries. But the relatively large number of these U.S. agreements has caused some concern among analysts here precisely because of their size and the length of time they are to run. The natural gas agreements in particular involve

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\*Analytical Report on Industrial Co-operation Among ECE Countries of the Economic Commission for Europe, Twenty-eight session, published by the United Nations Economic and Social Council, E/ECE/844, Add. 2, 9 April 1973 (hereafter referred to as E/ECE/844, Add. 2), pp. 14-15.

large credits and run for 25 years. The Occidental fertilizer complex contract is for 20 years, the Pepsi-vodka barter is for 10 years, and the smaller Occidental metal finishing contract is for five years. Such large long-term credits may not be economically sound, and may involve commitments which for political reasons are not prudent.

The UNESCO report found that many co-production agreements led to joint research and development.\* The converse is true of the agreements analyzed here. According to Eastern Europe Report, the Hewlett-Packard agreement on medical electronics, small computers and measuring instruments calls for cooperation in production and development. A Soviet source, however, referred only to technical-scientific cooperation.\*\* Many more of the agreements analyzed here called for cooperation in R&D and the exchange of information, but had no explicit provisions for co-production. Frequently, scientific-technological cooperation agreements, such as the American Can Company arrangement and the Control Data agreement, called for co-production as the eventual goal. Thus, the information here seems to indicate that joint research and development agreements may lead to co-production more often than the reverse.

The nature of cooperation in co-production renders the partners more interdependent. Perhaps the Soviet Union is avoiding such interdependence. This would account for the discrepancy between the findings on co-production in this report and the findings in the UNESCO report.

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\*E/ECE/844, Add. 2, op. cit., p. F.

\*\*Soviet Business & Economic Report, a joint publication of Tass News Agency and Porter International, June 11, 1973, p. 3.

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Joint ventures involve co-management, co-ownership of capital, and a sharing of profits and risks. Because of the close cooperation required for joint ventures, the absence of such agreements is significant for the political ramifications of developing economic ties with the U.S.S.R. The Soviet Union wants the benefits of Western technology without the drawbacks which co-management with Western firms would entail for their political system.

The non-reciprocal exchange of information and personnel is a continuing concern. One analyst states that the British and French perceive an increase in trade, not the reciprocal acquisition of technology, as the advantage to be gained from technological cooperation with the Soviets.\* A U.S. food processor hoped that its technological cooperation with the Soviet Union would eventually lead to co-production, and the AIAA hoped that its exchange of personnel would lead to a sale of the U.S. system for air-traffic control. Almost all of the scientific-technological agreements analyzed either call for eventual industrial cooperation or already involve industrial cooperation. Some of the agreements which are not related to industrial cooperation are made in the hope of increased sales. For the West, technological "exchange" with the Soviet Union has, in some cases, assumed the mantle of public relations work, wooing Soviet business, more than the notion of reciprocal exchange.

Some fear has been aroused in the West that the Soviet Union will continue with technological cooperation as long as it can acquire technology at no cost, and will retreat from an agreement when asked to enter

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\*"Selling know-how to the Soviets," by Dr. Sara White, New Scientist, 19 April 1973, p. 162.

into industrial cooperation. Indeed, the pharmaceuticals agreement with Great Britain, which calls for eventual exchange of licenses for the drugs developed, is hedged with the stipulation that this exchange will be at the partners' discretion. The possibility of uneven exchanges of know-how, and the possible failure of "exchange" as public relations' work, are factors to be reckoned with when dealing with the Soviet Union.

An economic advantage of scientific-technological cooperation offsets these risks somewhat. Western companies can benefit from sharing research and development costs with the Soviet Union, since the U.S.S.R. has an extensive network of research institutes, staffed with highly-qualified specialists who receive lower pay than in the West.

The frequently expressed fear may be exaggerated that giving the Soviet Union substantial U.S. technology will enable them to establish economic, if not military, superiority. But the role of technology exchanges in overcoming poor Soviet scientific/industrial organization cannot be underestimated. The major problem afflicting the Soviet economy is not the lack of scientific know-how and R&D. Rather, Soviet productive capacity is hampered by an inability to put new technology into practice. The Soviets are aware of this difficulty, as indicated by articles in their press. While the Soviets may not be able to exploit to the fullest the technology they gain from the West, they are nevertheless helped by imported technology.

The significance of the exchange of scientific and technical personnel is difficult to judge in advance. Some observers of U.S.-Soviet cooperation in the space program have discouraged expectations of achieving a substantial degree of reciprocity in scientific exchanges.

The Soviets have expressed extreme concern over the potential consequences of large numbers of Western businessmen and scientists coming into regular contact with Soviet citizens. Indeed, the vehemence of Soviet attacks on Western ideology indicates that this ideology may already have made significant inroads on the Soviet system.

### Conclusion

The pattern of Soviet imports of foreign technology emphasizes the unquenchable Soviet demand for Western and particularly U.S. technology. As reflected by Soviet purchases and agreements, an attempt is being made to advance the sophistication of the Soviet industrial and agricultural establishment across a broad front. The evidence does not suggest a high degree of specialization in the Soviet demand for imports. Thus, the Soviets do not seem intent on employing imported technology for the priority modernization of any particular sector of their economy. Rather, they are behaving as if foreign technology imports were being rationed among the host of Soviet ministries seeking to upgrade their performance.

In terms of maximizing the mutuality of technology exchanges, the highest "payoff" appears to be in the area of joint research and development projects. The least advantageous form of technology transfer for the United States involves U.S. Government financing of long-term co-production schemes. Here the U.S. subsidizes the financing of a major investment in the Soviet Union in the long-term expectation of achieving a return through the output of the Soviet installation. The payoff period is likely to be extremely long, and is representative of a type of arrangement which would not otherwise be commercially viable without U.S. assumption of the risks.

#### IV. THE SOVIET PROCESS OF TECHNOLOGY ASSIMILATION

We will examine here several models of the Soviet process of technology assimilation.\* Before setting forth these models, we will note some of the obstacles and strengths peculiar to the Soviet Union. In essence, we attempt to look at the Soviet ability to absorb technology versus the economic and political costs their system must pay.

The principal obstacle facing the Soviet Union in their drive to assimilate sophisticated Western technology is the lack of necessary economic infrastructure and technologies, coupled with an insensitivity to the need for such infrastructure. This is most evident in the case of automated feedlots, where the supportive requirements range from a modern fertilizer industry to an inter-farm marketing system, and from ample electric power to a good rural road system.

There is a definite need to organize an "infrastructure for negotiations," in order to speed the initiation and conclusion of business agreements. The use of U.S. industry associations has been suggested for this purpose. Such an organization must include accessibility to Soviet business data, an area which is virtually closed to U.S. businessmen and bankers at the present time. More specifically, more details must be known about product cost structures, ability to repay debts, and quantities of resources currently and likely to be committed as payments to other

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\*The primary assumption of this section is that the Soviets are truly looking to import technology, so as to be able to develop a least-cost combination of inputs resulting in optimal, or most efficient, production and distribution schemes, rather than just overcoming bottlenecks or doing a "quick fix" on their industrial sector with the objective of returning to an autarkic society.

foreign countries. Western firms must be allowed into the Soviet Union to make their own estimates of a particular business situation. Until recently, the Soviet inability to close deals with the Japanese government for the development of Siberia stemmed from the fact that the Soviets would not allow the Japanese to travel in Siberia and make their own estimates.

The one Soviet sector that appears promising for earning substantial foreign exchange is natural gas. However, the delivered price of natural gas from foreign sources is critical, in that gasification of U.S. coal becomes economic at \$1.50-\$2.00 per million BTUs.

One prime requirement of sophisticated technology is the so-called "fourth" level of transfer, i.e., that of turning applied research into commercial operations by organizing and applying managerial capacity. In the first two stages, those of material and design transfers, the Soviets are fairly well along. They have some modest experience in capacity (third stage), i.e., that of assimilating the development of the educational system necessary to design the plant. However, it is in the last stage that they are particularly deficient and it is from this area that the payoff comes. Currently, importing plants and equipment permits the Soviets to avoid this phase.

If the Soviets import automotive, petroleum and feedlot technologies, they certainly will have to employ considerably more of their own resources in order to obtain effective use of the technologies.

#### 1. U.S.-Guided Model

One possible model of technology assimilation entails United States' guidance in transferring only those technologies which the Soviets

can reasonably absorb and which fill gaps in their present technologies, as well guidance in creating the necessary infrastructures.

This would include an investigation of the types of technology which would offer differing degrees of productivity growth, taking into account Soviet political and institutional constraints. For example, improvement of the efficiency of their agricultural system (e.g. better rural roads, fertilizer industry, etc.) should precede any investment in a technology as capital intensive and sophisticated as automated feedlots. Another area in which the Soviets are sadly deficient and in need of guidance is that of quality control techniques and standards. Improvement of quality control would increase the productivity and efficiency of the Soviet economy--both its civilian and military sectors.

Further, it may well be to the Soviets' advantage that they do not have the infrastructure to support obsolete technologies--in effect, they will start out fresh. This is the case of the Kama River truck facility, where the Soviets are starting with all the advantages of the most up-to-date technology. On the other hand, there is a prospect that large-scale Soviet production of automobiles could well cause serious economic and societal problems. Thus, it would behoove both sides to discuss and recognize the long-term implications of large-scale investment decisions to be made in the near future.

In addition, this model requires an important element of U.S. reciprocity in long-term arrangements, in order to lessen the economic impact on the U.S.S.R. Reciprocity could take the form of financing arrangements, purchasing agreements and technological assistance--including the continued transfer of technological advances. Such an arrangement would

entail acceptance of repayment partially in natural resources (energy, metals, etc.), after having allowed for a grace period of ten to fifteen years for the exploitation of these resources to commercial levels, and payment partially in other exports with easy credit.

Reciprocity could also arise in the transfer of technology from the Soviets to the U.S., such as the technology to produce alumina from low-grade bauxite (recently negotiated between several large U.S. aluminum companies and the Soviet Union). In the past, the U.S. had easy access to high-grade bauxite, and did not develop processes to treat lower-grade ores. If mineral-producing countries were to restrict production or create artificially high prices for their resources, the transfer of these technologies would become more meaningful to the U.S.

A further advantage in U.S. guidance of the Soviets is that certain technologies and equipment is of such nature that it requires updating, improving or follow-on servicing which only the U.S. could provide. Further linkages in marketing are possible, especially in long-term deals where part of the production will be set aside for a U.S. firm to market in the West.

The Soviets have realized that, given their priorities, they are no longer able to import selected equipment, but rather must import whole technologies. It is at this threshold that technological exchange becomes effective. In addition, they have recognized that a compromise between Western and Soviet concepts of efficiency is necessary. The compromise apparently is satisfactory to them in the short run, and serves to improve existing conditions. Also, the Soviets have the potential to

compete and there is no reason to assume that they cannot learn to conduct their own marketing, servicing and follow-up on sales.

To encourage financing the Soviets will permit the return of initial investment and profits to foreign ownership. Where large amounts of capital are involved, they are agreeable to the creation of joint governmental consortia.

## 2. An Export-Led Model

A promising scenario of technology assimilation would entail the development of an export capability along the lines of Japan's export-led economic growth. The Soviets after all have more resources and potential than do the Japanese. The Soviets' interest in the development of an export sector is shown by the rotation of managers through their Tokyo offices, in order to acquaint them with Japanese export development.

In such a model, the Soviets initially would concentrate on those areas which they understand best and are sufficiently large. Japanese-style "planning for export growth" by the Soviets would have to include imports of U.S. technology, such as process controls, which would make their industrial and export sector more efficient.

Low Technology Areas. In low-technology areas, such as crude formed and semi-finished structural steel products, the Soviets would be in a favorable position to export to the West in the following way:

- a. Fabrication of crude formed steel to cover the shortfall of the U.S. steel industry. It is possible that the Soviets could compete on a price basis.
- b. Steel for finishing in the United States or West Germany, and for subsequent sale.

- c. Steel to West Germany for finishing and export to the United States.

In areas of low technology, the Soviets would be able to use their level of expertise, as well as to avoid the more complex requirements of finished products--marketing, servicing, spare parts, etc. In high technology areas, they would encounter two additional problems--quality control and scheduling--in which they currently lack expertise.

Another low technology industry in which the Soviets already have had a measure of export success is basic chemicals. The key to the success of this trade was that Britain was willing to accept lower-quality chemicals than were produced in the U.K.--at a correspondingly lower price.

In order to establish and develop an important export sector, a fifteen or twenty year-period is probably a minimum requirement. Such a time period, coupled with advanced technology, may well enable the Soviets to develop export industries which can be effectively marketed in the West.

#### Other Potential Areas of Development

In time, the automotive area will become a reservoir of expertise, based on the capital investment the Soviets have made and the technical knowledge gained from building Fiats and developing the Kama River truck project.

Services represent another possibility for Soviet development. Currently, they maintain the world's sixth largest merchant fleet and have started to carry third-country trade in the Pacific. Other intangible export areas are scientific research and development work, as well as consulting and specification work for large development projects (dams,

river basin projects, etc.). To date, very little has been done to promote tourism--an extremely valuable source of foreign earnings for many other countries. Other export possibilities to the U.S. market include Soviet aircraft, electric power equipment, lathes, watches, cameras and bicycles.

Another possibility is that of encouraging export industry development on the Black Sea littoral in the Japanese manner, i.e., seaside facilities which reach out for raw materials from all over the world, store and process them, and then resell them as finished goods.

#### Problems Inherent in the Model

The Soviets are looking for a long-term relationship with the United States on the basis that we will supply the necessary technology and be paid off in output of products. Yet, in most cases we can build plants in the U.S. which produce the goods more cheaply. Moreover, what are Soviet export possibilities which will permit them to pay for imported technology? To a great extent the world market will determine what they will be able to export, while credit availability will largely determine the level of their imports.

Resource Constraints. The Soviets will not be able to bend their entire economy to support a few large export industries--especially if these industries involve a huge commitment in terms of resources, as in the extractive industries.

Closed Economy. To a large degree the Soviets are potentially self-sufficient as we are, whereas the Japanese, British and West Germans, for example, have to trade to raise their standard of living. An emphasis on the export sector to lead the growth of their economy may be just as foreign to the Soviets as it would be to us.

Limited Number of Areas. Currently, the Soviets lack a large number of products in which they have a comparative advantage. Their weakness shows in being unable to meet the sophisticated demands of high-level technology and the Western marketplace, i.e., quality and quality control, scheduling, marketing, maintenance and service. The alternative is to emphasize those areas where the West can provide marketing and service expertise, either directly or through the use of Western distributors. Nowhere is this more evident than in machine tools, where Soviet trade is extremely lopsided, i.e., where its imports far outweigh its exports.

### 3. Centrally-Planned Model

This model for technology assimilation is based on a centrally planned effort by the Soviet government. Since both the U.S. and Soviet economies are so large and the investment requirements on the Soviet side are equally large, centrally-planned assimilation by the Soviets may be a necessity.

Linkages and Bottlenecks. The size of Soviet investment in advanced technologies will require horizontal linkages between various sectors, as well as vertical linkages within each sector. The Soviets have an awareness of these linkages from their experience with the chemical industry. They learned that the chemical industry had strategic military implications but also that there was a direct tie to agriculture through fertilizer, and to consumer goods through synthetic fibers. A lack of planning and organizational abilities caused them to absorb the British chemical investment extremely slowly.

The Large Scale of Needed Technology. The mere size of the planned Soviet effort in economic development is exemplified by the priorities for opening up Siberia, the development of petroleum and natural gas production, the purchase of automated feedlots as a means of rapidly increasing the amount of meat in the Soviet diet, and the development of the automotive industry. All this calls for massive injections of technology and a concomitant infrastructure buildup. The infrastructure requirements are a key to Soviet development, since they determine the degree to which the Soviets can assimilate imported technology. Such a large-scale effort imposes certain requirements on the Soviets:

- a. A centrally planned effort calls for the application of military-type priorities.
- b. The Soviets must deal with large firms, or consortia of large firms, not only for the infrastructure and technologies themselves, but also for the financing of such enterprises.
- c. With the possibility of an energy crisis in the 1980s, caused by great energy demand by both the Soviet Union and the COMECON countries,\* a priority for the development of Siberia becomes critical. In addition, only natural gas promises to generate sufficient Western credits.

In April 1974, the Soviets and Japanese reached an agreement on the Japanese financing of three natural gas, coking coal, and forestry projects, with repayment to the Japanese from the output of the three projects. In order to get financial and technological assistance, it is likely that the Soviets "subsidized" the price of the products to the Japanese, to reflect what the Japanese were willing to pay.

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\*It may well be that the internal Soviet demand for natural gas and oil, as well as that of COMECON, will preclude exporting significant amounts of gas and oil by the end of this decade.

- d. Under a centrally planned effort, certain institutional changes will be necessary:
- The resolution of the government economic planner-industrial manager conflict: the self-interest of plant managers often clashes with the preferences of government planners.
  - An increased ability to change priorities rapidly in order to meet new needs and problems.
  - Active restructuring of research and product development so that there is a smooth flow from concept to product.
  - A definite move toward accepting decentralized decision-making.
  - Avoidance of overfull employment planning, whereby planned demand exceeds available supply. Under overfull employment planning, domestic producers and consumers fight for exports and imports, thereby aggravating the country's balance of payments.

#### Specific Problem Areas

Automated Feedlots. There is a distinct danger that the Soviets will attempt to develop feedlots hurriedly and on a mass scale, without having the infrastructure and organization requirements. The Soviets will have to pay the price of diverting land capacity for feed grains or importing feed grains. In addition, there is a sheer lack of feeder cattle.

Localism. In developing Siberia, the regional political organization may develop an economic interest that is different from Moscow's, e.g., should Siberia be oriented toward European markets or toward Japan and the Pacific? Should the local level be responsible for the infrastructure development of Siberia or should Moscow?

Labor-Intensive Economy. One of the major problems facing the Soviets is that they want high-volume, capital-intensive equipment, i.e., they want equipment which will turn out volume with little labor--but their economic system has a high manpower orientation.

#### 4. A Civilian/Defense Priority Model

This model of technology assimilation assumes a priority being given to the civilian sector at the "expense" of the defense sector, with tradeoffs between technology transfers and threat reduction. A concentration on the civilian sector would also require certain significant changes in the modus operandi of the Soviets, and a recognition that the greatest potential for economic growth resides in the civilian sector.

A further impetus to this model comes from the fact that in the past the Soviets stressed the development of the military and heavy industry at the expense of the standard of living. Today, the Soviet citizen is less willing to accept World War II and its aftermath as reasons for his sacrifice.

For a priority to be given to the civilian sector, the first requirement would be an arrangement to reduce certain of the Soviet-perceived military pressures (China, West Germany, Eastern Europe). A force-reduction agreement in Europe could represent the means to partially remove the perceived threat, reduce the defense budget, and thereby release resources which could be reallocated between the remaining military needs and new civilian requirements.

A reduction in the perceived threat could lead to the freeing of a substantial number of young men from the Soviet army. Such an increment to the labor force, along with the employment of under-utilized national

minorities available in small cities, could have a significant impact on Soviet industrial productivity.

Without a reduction of military pressures, the danger is that in supplying the Soviets with massive amounts of capital and high-level technology, we will permit them to divert domestic resources to the military.

The second requirement entails a lesser degree of Soviet rigidity in the setting of long-term military priorities and the allocation of resources to these priorities.

#### New Institutional and Operating Arrangements

More efficient development of the Soviet civilian economy with U.S. capital and technology would entail Soviet acceptance of new institutional and operating arrangements. Current U.S.-Soviet arrangements call for cooperation in research and development and information exchange, where a greater degree of interdependence would be necessary--implying at the least, provisions for co-production, and possibly joint ventures involving co-management, co-ownership, and profit/risk sharing.

Joint foreign participation would also call for some new operating principles for the Soviets: the creation of joint stock companies in which the Soviets would have an equity position; operations based on profit principles; and operations where the primary objective would not be the widening of the Soviet state economy.

The Soviets have indicated a desire to create, on a reciprocal basis, enterprises in the U.S. Possible ventures might include metallurgical operations, such as coking, blast furnace converter production facilities,

and installations for continuous steel casting; hydro-electric and thermal electric power stations; high-voltage transmission lines; and dams.

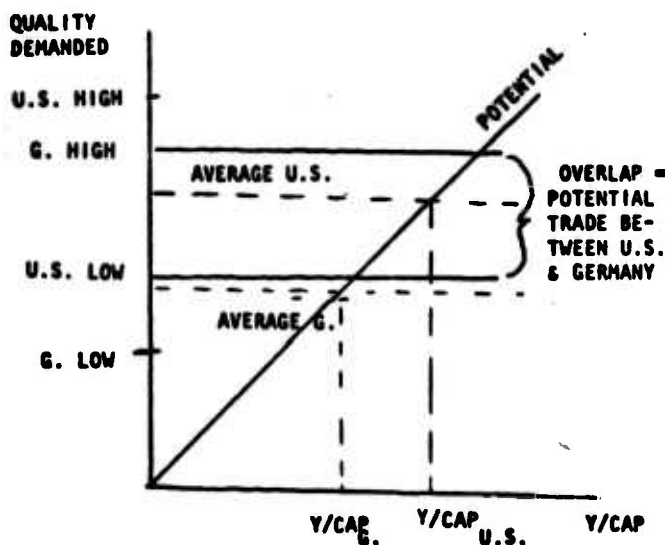
Linder Trade Model

The model of the civilian sector as the vehicle for assimilating technology has the added attraction of long-run development of manufactures, as well as the development of Soviet demand for U.S. manufactures-- i.e., leading to vastly increased trade possibilities on the lines of the Linder trade model described below:

LINDER MODEL OF TRADE

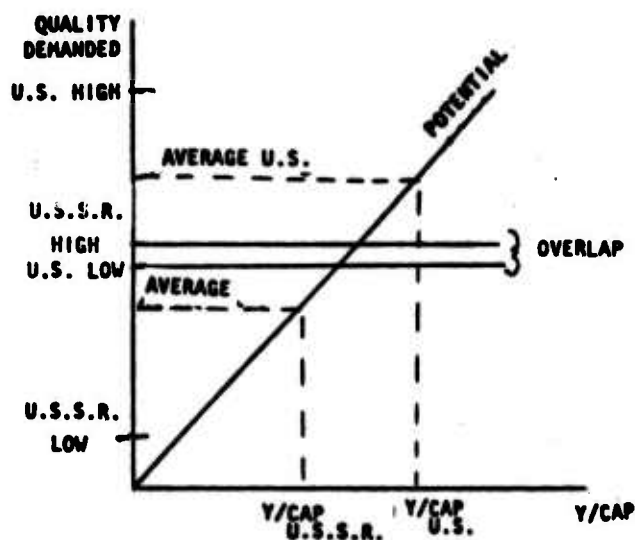
THE GREATEST VOLUME OF TRADE OCCURS BETWEEN COUNTRIES WITH SIMILAR FACTOR ENDOWMENTS AND SIMILAR INCOMES PER CAPITA, E.G., BETWEEN EEC MEMBERS AND/OR BETWEEN THE U.S. AND EEC MEMBERS. ALSO, THE VOLUME OF TRADE WILL BE HIGHER AMONG DEVELOPED (INDUSTRIAL) COUNTRIES THAN BETWEEN DEVELOPED AND UNDERDEVELOPED (PRIMARY PRODUCTS) COUNTRIES. IN THIS MODEL, COUNTRIES' DEMAND STRUCTURES FOR MANUFACTURED GOODS ARE OF PRIMARY IMPORTANCE, AND THE VOLUME OF TRADE DEPENDS ON THE OVERLAP OF COUNTRIES' INTERNAL DEMAND STRUCTURES. IF TWO COUNTRIES HAVE PRECISELY THE SAME DEMAND STRUCTURES, THE EXPORTABLES AND IMPORTABLES OF ONE ARE THE EXPORTABLES AND IMPORTABLES OF THE OTHER. SINCE INCOME PER CAPITA INFLUENCES THE QUANTITY AND QUALITY OF DIFFERENT GOODS CONSUMED, COUNTRIES WITH DIFFERING LEVELS OF INCOME PER CAPITA WILL DEMAND DIFFERENT KINDS OF CONSUMPTION AND PRODUCTION. IN THE COMPARISON OF DEMAND STRUCTURES, SLIGHT QUALITATIVE DIFFERENCES IN SIMILAR COMMODITIES MAY INTRODUCE SIGNIFICANT CHANGES IN ONE COUNTRY'S DEMAND STRUCTURE COMPARED TO THAT OF ANOTHER.

U.S. - GERMANY



Y/CAP = INCOME PER CAPITA

U.S. - U.S.S.R.



- A. THE POTENTIAL CURVE SHOWS THAT AT EVERY LEVEL OF INCOME PER CAPITA, THERE IS AN AVERAGE LEVEL OF SOPHISTICATION IN MANUFACTURED GOODS.
- B. A COUNTRY'S EXPORTS OF MANUFACTURES ARE NECESSARILY BASED ON DOMESTIC MARKETS.
- C. THE CLOSER THE INCOMES PER CAPITA, THE LARGER THE TRADE OVERLAP WILL BE. CONSUMPTION PATTERNS IN MANUFACTURED GOODS CHANGE WITH LEVELS OF INCOME, AND TECHNICAL CAPACITY DEPENDS ON A LARGE INTERNAL MARKET. THEREFORE TRADE IN MANUFACTURES TAKES PLACE MUCH MORE BETWEEN DEVELOPED COUNTRIES WITH SIMILAR STANDARDS OF LIVING THAN BETWEEN DEVELOPED COUNTRIES AND UNDERDEVELOPED COUNTRIES WITH DISSIMILAR FACTOR ENDOWMENTS.

THUS TRADE BETWEEN THE UNITED STATES AND GERMANY WOULD TAKE PLACE BETWEEN G HIGH AND U.S. LOW. TRADE BETWEEN THE U.S. AND THE SOVIET UNION WOULD BE MUCH LESS, AS THE DIAGRAM SHOWS.

THE FLOWS OF TRADE WITHIN THE OVERLAP ARE SUBJECT TO THE SAME INFLUENCES DETERMINING INTRAREGIONAL TRADE, VIZ: TRANSPORT COSTS, PRODUCT DIFFERENTIATION AND SALES PROMOTION, MONOPOLISTIC COMPETITION, ADVERTISING INNOVATIONS, SHIFTING SUPPLY CURVES, TARIFFS, ETC. EXPORT GOODS WOULD TEND TO BE THOSE GOODS FOUND TOWARD THE MIDDLE OF THE COUNTRY'S DEMAND STRUCTURES AND IMPORT GOODS TOWARD THE EXTREMES.

IN SPITE OF THE DEMAND AND INCOME PER CAPITA CONSIDERATIONS, LINDER'S THEORY DOES NOT ALTER THE HECKSCHER-OHLIN PREDICTIONS VIS-A-VIS GAINS OF TRADE AND EFFECTS OF TRADE. THE VALUE OF LINDER'S THEORY LIES IN ITS FOCUS ON DEMAND--A FACTOR WHICH HECKSCHER-OHLIN VIRTUALLY IGNORE, AS WELL AS THE FACT THAT LEVEL OF PER CAPITA INCOME DETERMINES DEMAND STRUCTURE.

- D. FOR TRADE IN PRIMARY PRODUCTS, THE LINDER MODEL IS IN AGREEMENT WITH THE H O MODEL. A COUNTRY ABUNDANTLY SUPPLIED WITH A NATURAL RESOURCE WILL BE ASSUMED TO HAVE A COMPARATIVE ADVANTAGE IN THE EXPLOITATION OF THE RESOURCE.
- E. THERE'S LESS LIKELY TO BE INTERNATIONAL DIFFERENCES IN PRODUCTION FUNCTIONS FOR PRIMARY PRODUCTS THAN FOR MANUFACTURES; AND SINCE PRIMARY PRODUCTS ARE CHARACTERIZED BY A PARTICULAR FACTOR INTENSITY, IT IS CLEAR THAT THE FACTOR PROPORTIONS THEOREM IS PERTINENT TO TRADE IN PRIMARY PRODUCTS.

- F. WHEN COMPARING DEMAND STRUCTURES, IT IS NECESSARY TO DEFINE GOODS BY SPECIFYING QUALITY. A COUNTRY WITH A LARGE INTERNAL MARKET FOR LOW-UTILITY GOODS IS MORE LIKELY TO COMPETE SUCCESSFULLY IN COUNTRIES WITH A DEMAND FOR SIMILAR GOODS THAN ONE WHOSE INTERNAL MARKETS ARE MAINLY IN GOODS OF HIGHER QUALITY BECAUSE LESS ADAPTATION OF PRODUCTIVE PROCESSES TO EXPORT REQUIREMENTS WILL BE NEEDED IN THE FORMER CASE,
- G. THE LEVEL OF AVERAGE INCOME IS THE MOST IMPORTANT SINGLE FACTOR AND IT HAS A DOMINATING INFLUENCE ON THE STRUCTURE OF DEMAND.
- H. THE HIGHER THE PER CAPITA INCOME, THE HIGHER WILL BE THE DEGREE OF QUALITY CHARACTERIZING THE DEMAND STRUCTURE AS A WHOLE.
- I. THE MORE REPRESENTATIVE THE DEMAND FOR A GOOD IS, THE MORE LIKELY IT IS THAT THIS GOOD WILL BE AN ACTUAL EXPORT GOOD. ALTHOUGH PRODUCTS FALLING WITHIN THE RANGE COULD BE EXPORTED FROM ONE COUNTRY TO ANOTHER, IT IS LIKELY THAT A COUNTRY WILL EXPORT PRODUCTS BEING CLOSER TO THE AVERAGE DEMAND IN THE OTHER COUNTRY.
- J. THROUGH THE DIVISION OF LABOR, NATURAL SKILLS WILL DEVELOP AND BE STRENGTHENED IN FIELDS THAT HAVE BECOME TYPICAL OF EACH COUNTRY. AN EMERGING PATTERN OF TRADE WILL AFFECT THE FUTURE ENVIRONMENT OF INVENTORS AND INNOVATORS. ON THE OTHER HAND, AS A COUNTRY GROWS AND ITS PER CAPITA INCOME INCREASES, THE DEMAND STRUCTURE OF THAT COUNTRY WILL CHANGE. AS A CONSEQUENCE, THE RANGE OF POTENTIAL, AND THUS ACTUAL, EXPORTS WILL CHANGE.
- K. TRADE-BRAKING FORCES MAKE ACTUAL TRADE SMALLER THAN POTENTIAL TRADE; VIZ: DISTANCE, TRANSPORT COSTS, MAN-MADE OBSTACLES (E.G., TARIFFS, ARTIFICIAL EXCHANGE RATES, ETC.)

THE TRADE-BRAKING FORCES NOT ONLY MAKE ACTUAL TRADE SMALLER THAN POTENTIAL TRADE; THEY ALSO INTRODUCE DISTORTIONS IN THE SENSE THAT COUNTRIES WITH SIMILAR PER CAPITA INCOME LEVELS DO NOT NECESSARILY TRADE MOST INTENSIVELY WITH EACH OTHER.

- i. THE DISTANCE FACTOR MAY, FOR INSTANCE, MEAN THAT ENTREPRENEURS ARE NOT EVEN AWARE OF THE MARKET OPPORTUNITIES IN SOME DISTANT COUNTRY.
- ii. CULTURAL AND POLITICAL AFFINITIES OR AVERSIONS WHICH WILL DISTORT TRADE WITHOUT REDUCING IT.

## V. SOVIET EXPORT POTENTIAL

The Soviet Union is in many ways an industrial nation. But from the perspective of exports, the U.S.S.R. has many of the characteristics of an underdeveloped nation. The composition of Soviet exports to the U.S. for the first quarter 1974, illustrates the nature of the Soviet economy. The Soviet exports totaled \$99 million to the U.S., of which \$40 million consisted of platinum metals, \$41 million was petroleum and petroleum-related products, and the remainder, \$18 million, covered a variety of relatively minor products.\*

For all of 1974, the Department of Commerce estimates that total Soviet exports to the U.S. will be approximately \$410 million--nearly twice the level of \$214 million in 1973. But for the first time since 1968, Soviet imports are expected to decline from \$1.2 billion in 1973 to \$1 billion in 1974. This decline reflects an improved agricultural harvest in the Soviet Union, reducing their demand for American agricultural products.

It is the composition of the Soviet export-import mix which reflects the traditional trading pattern of an underdeveloped nation: the U.S.S.R. exports raw materials and imports finished products. A large number of hypotheses may be used to explain this situation. But one important component of any explanation is the long-term Soviet preference for economic autarky. As a result, external competition has been inhibited from forcing the development of Soviet industry and agriculture to produce exportable materials consistent with the Russian natural comparative advantage.

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\*U.S. Dept. of Commerce estimates.

By not competing in the international export market, the Soviet economy has lacked several major characteristics which otherwise would permit Soviet exploitation of areas of comparative advantage. These weaknesses include:

1. service capability
2. ready availability of spare parts
3. sufficient model variety
4. high product quality
5. design and scheduling expertise
6. marketing expertise

Even within their own economy, the Soviets have had a persistent inability to produce sufficiently for internal consumption, leaving aside export production. They have also shown difficulty in developing an adequate maintenance system, including the availability of spare parts and adequate service. A heightened awareness of this shortcoming must result from greater contact with foreign vendors of technical products now competing in the international economy. As a result, some Soviet products which reflect high standards of engineering and production have met with limited acceptance; they are assumed to have high operational costs because of inadequate servicing and the limited availability of spare parts. This is particularly true in fixed-wing aircraft and helicopters for the civilian market. These products reflect the high level of development attained by the Soviet defense establishment. Some evidence suggests that the Soviets may seek to contract with Western marketing and service organizations to provide the maintenance, infrastructure and marketing expertise currently lacking in Soviet industry.

Within the Soviet economy, related problems of model variety and product quality also conflict with current international standards. In

American terms, the Soviets produce a relatively undiversified product line. Moreover, Soviet production and incentives have provided for only limited quality control. These attributes make it difficult for Soviet industrial products to gain international acceptance. In the near-term, it is expected that the Soviet Union will be unable for these reasons to compete effectively in international markets, in comparison to its major competitors, except in some specialized areas.

The key element in Russia's export potential is the development of natural gas reserves; ultimately, this is the key to the dimensions of U.S.-Soviet technology transfers. Russian natural gas reserves are estimated to be 8 to 10 times as large as those of the United States. Moreover, unlike liquid petroleum, Soviet natural gas reserves are expected to continue to exceed their own demand for the next ten to fifteen years.

Because of domestic and COMECON commitments, the U.S.S.R. has already limited its exports of petroleum. Furthermore, Soviet fuel consumption is 84 percent of the U.S. figure, although Russian industrial output is only 60 percent of that of the U.S. As long as the Soviet Union will maintain relatively high rates of economic growth, it will be substantially limited in its ability to produce sufficient liquid petroleum for export. The Soviet petroleum industry is in addition characterized by antiquated drilling technology, and by management techniques which are inadequate for exploiting existing reserves.

By comparison, natural gas would be almost exclusively developed for the export market. The Soviets have sought to make barter arrangements whereby the output of natural gas fields, developed primarily by the U.S. and Japan, would be used as payment to amortize the foreign investment.

But there is considerable skepticism concerning the price at which natural gas might be delivered in the future. And whether gas could be successfully exploited and marketed would be highly sensitive to the potential development of alternatives, including coal gasification and synthetic natural gas.

If the natural gas fields can be exploited, it has been estimated that the Soviets would earn net hard-currency revenues of as much as \$400 million per year. In any case, the level of hard currency earnings will be an essential ingredient in the Soviet ability to sustain high levels of technology imports. Only with a substantial improvement in Soviet export prospects will it become plausible for the U.S.S.R. to reach and sustain the \$3 billion level that some analysts have predicted for the 1980s.

If the Soviets exploit their mineral resources with the same determination with which the Japanese became producers of advanced industrial products for export, the U.S.S.R. might eventually become a strong international competitor and, consequently, a viable importer of advanced Western technology. But the Soviet demand for imports will probably not be met in the absence of Soviet development of new export markets, particularly for its minerals.

The existing Soviet methods of financing their technology imports have raised the Soviet debt service ratio to 25 percent. By 1980, the debt service ratio may exceed 50 percent if current trends in Soviet imports are continued. Such an extremely high debt service ratio would normally make conventional commercial trading impossible to finance. Only two alternatives would therefore seem to be feasible: 1) direct or indirect U.S. Government intervention to facilitate the Soviet financing of trade,

thereby assuming the risk inherent in the increasing Soviet debt service ratio; or 2) expansion of Soviet export activities to the point where a higher level of Soviet imports would become sustainable.

One of the possibilities for increasing the level of Soviet trade might be the use of triangular Soviet trade with other developed or underdeveloped nations. This might enable the Soviets to gain hard currency for direct dealings with Western countries. Exports of lower-quality Soviet goods may be feasible to underdeveloped countries. And as the Soviets gain expertise in marketing their products internationally, they may eventually develop more industrial products for sale to other countries.

As shown in the table below, the Soviet debt burden and debt service ratio has been rising generally since 1960:

#### DEBT BURDEN OF THE U.S.S.R.

In millions of U.S. dollars			
	Hard currency exports	Debt service <sup>1</sup>	Debt service ratio <sup>2</sup> (percent)
1960.....	768	39	5
1961.....	900	76	8
1962.....	951	116	12
1963.....	1,012	144	14
1964.....	1,073	162	15
1965.....	1,374	166	12
1966.....	1,517	169	11
1967.....	1,711	181	11
1968.....	1,909	253	13
1969.....	2,125	327	15
1970.....	2,197	398	18
1971.....	2,652	483	18
1972 <sup>3</sup> .....	2,900	563	19

<sup>1</sup> Payment of principal and interest.

<sup>2</sup> Ratio of debt service to hard currency exports.

<sup>3</sup> Preliminary.

This suggests the long-term financing problem facing the U.S.S.R., and indicates perhaps a fundamental inability to export goods and services which are competitive in the world economy. The high debt service burden may also provide an additional incentive for the Soviets to resist paying market rates of interest.\*

Perhaps the most promising means in the near future for financing Soviet trade is through Soviet gold sales. According to one estimate, the U.S.S.R. has approximately 200 tons of gold available annually for foreign sales, without reducing Soviet reserves.\*\* At a price of \$150 per ounce, this would represent more than one billion dollars in annual hard currency income. The gold market, however, is relatively thin, and 200 tons of gold for sale in the international market would probably depress the price. Nevertheless, hard currency earnings from gold sales do represent the most significant potential contribution to Soviet hard currency reserves which might be available in the next few years.

Certainly the prospects for significant exports of Soviet non-extractive industry products are not bright. Farrell has noted that:

"Soviet attempts to improve sales of manufactured goods have made little headway, and the prospects for such increases in the near future are not good. For a few items where the U.S.S.R. has made a real effort or has

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\*It should be noted that the Soviets have recently agreed to finance their projects at a rate which corresponds to the U.S. prime interest rate. While this would result in a higher average finance cost to the Soviets than they have been accustomed to paying, it does serve to constrain the extent of Soviet interest payments to an upper bound. Thus, they are less likely to be subject to the market evaluation of relatively high-risk projects, such as the oil and gas development of Eastern Siberia, where the chances of failure may be sufficiently high to warrant a higher rate of interest.

\*\*John T. Farrell, "Soviet Payments Problems in Trade with the West," Soviet Economic Prospects for the Seventies, Joint Economic Committee, Congress of the United States, June 27, 1973, p. 696.

a salable product--aircraft such as the YAK-40, TU-144, and helicopters; large-scale power generating equipment; and hydrofoils--it has made some progress. In general, however, the U.S.S.R. seems unwilling or unable to tailor its manufactured exports to Western markets or to provide servicing necessary to maintain sales."

In the table below, Soviet exports to the West have been divided by categories. This breakdown suggests that extractive industry exports are providing a growing share of total Soviet exports to the West. By contrast, manufactured and semi-manufactured materials are providing either a stable or a declining fraction of Soviet exports. This trend has accelerated as a result of post-1972 changes in raw material commodity prices.

**-SOVIET EXPORTS TO THE DEVELOPED WEST**  
[Dollar amounts in millions of U.S. dollars]

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Total exports.....	\$983	\$1,066	\$1,115	\$1,216	\$1,282	\$1,438	\$1,711	\$1,986	\$2,051	\$2,230	\$2,345	\$2,710
Percent.....	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000
Of which:												
Fuels, lubricants, and related materials...	\$253	\$287	\$326	\$389	\$401	\$390	\$466	\$549	\$609	\$596	\$675	\$938
Percent.....	25.738	26.846	29.238	31.638	31.279	27.121	27.236	29.109	29.693	26.728	28.798	34.613
Coal and coke.....	\$57	\$66	\$77	\$98	\$109	\$100	\$100	\$103	\$101	\$115	\$131	\$158
Percent.....	5.799	6.174	6.908	8.046	8.502	6.954	5.945	5.461	4.924	5.157	5.586	5.830
Petroleum and petroleum products...	\$196	\$221	\$246	\$291	\$292	\$290	\$366	\$446	\$506	\$469	\$529	\$757
Percent.....	16.639	20.674	22.332	23.892	22.777	20.167	21.391	23.648	24.671	21.031	22.516	27.934
Ores and concentrates.....	\$33	\$31	\$25	\$26	\$26	\$37	\$47	\$49	\$52	\$55	\$66	\$89
Percent.....	3.357	2.900	2.242	2.135	2.194	2.573	2.747	2.598	2.535	2.466	2.814	3.253
Base metals and manufactures.....	\$112	\$122	\$120	\$117	\$190	\$203	\$247	\$205	\$209	\$168	\$213	\$253
Percent.....	11.394	11.413	10.762	9.606	14.821	14.117	14.436	10.870	10.190	7.534	6.083	9.336
Farrous metals.....	\$72	\$82	\$85	\$84	\$115	\$120	\$125	\$111	\$92	\$101	\$123	\$120
Percent.....	7.325	7.671	7.623	6.897	8.970	8.345	7.306	5.665	4.486	4.529	5.245	4.429
Pig iron.....	\$68	\$41	\$46	\$42	\$48	\$51	\$61	\$55	\$40	\$27	\$29	\$25
Percent.....	6.916	3.835	4.126	3.448	3.744	3.547	3.565	2.916	1.950	1.211	1.194	.923
Rolled ferrous metals.....	\$21	\$25	\$26	\$29	\$38	\$30	\$25	\$22	\$23	\$31	\$35	\$30
Percent.....	2.136	2.339	2.332	2.381	2.964	2.088	1.461	1.166	1.121	1.390	1.493	1.107
Nonferrous metals.....	\$40	\$40	\$35	\$33	\$75	\$83	\$122	\$94	\$117	\$67	\$80	\$133
Percent.....	4.069	3.742	3.139	2.709	5.850	5.772	7.130	4.984	5.705	3.004	3.638	4.908
Aluminum.....	\$7	\$7	\$15	\$15	\$26	\$30	\$40	\$33	\$32	\$44	\$42	\$39
Percent.....	.712	.655	1.345	1.232	2.029	2.086	2.338	1.750	1.560	1.973	1.791	1.439
Wood and wood products.....	\$159	\$176	\$202	\$211	\$273	\$297	\$299	\$372	\$339	\$348	\$384	\$480
Percent.....	16.073	16.651	18.117	17.323	21.295	20.654	17.417	17.073	16.480	15.605	16.375	14.072
Lumber.....	\$100	\$107	\$110	\$125	\$159	\$165	\$155	\$141	\$138	\$145	\$140	\$137
Percent.....	10.173	10.009	6.865	10.263	12.402	11.474	9.059	7.478	6.728	6.502	5.970	5.055
Textile raw materials and semimanufactures.....	\$70	\$52	\$53	\$48	\$46	\$75	\$102	\$126	\$113	\$87	\$49	\$98
Percent.....	7.121	4.864	4.753	3.941	3.588	5.216	5.961	6.681	5.510	3.901	2.090	3.616
Cotton.....	\$50	\$35	\$32	\$30	\$31	\$56	\$80	\$108	\$102	\$77	\$37	\$88
Percent.....	5.086	3.274	2.870	2.463	2.418	4.103	4.676	5.726	4.973	3.453	1.578	3.247
Consumer goods.....	\$167	\$206	\$187	\$218	\$144	\$167	\$202	\$240	\$234	\$279	\$203	\$266
Percent.....	16.989	19.270	16.771	17.898	11.232	11.613	11.806	12.725	11.409	12.511	8.657	9.815
Food.....	\$116	\$158	\$133	\$140	\$70	\$90	\$113	\$146	\$143	\$700	\$116	\$174
Percent.....	11.801	14.780	11.928	11.494	5.460	6.259	6.604	7.741	6.972	8.969	4.947	6.421
Grain.....	\$85	\$128	\$94	\$70	\$16	\$20	\$3	\$32	\$37	\$69	\$73	\$46
Percent.....	6.647	11.974	8.430	5.747	1.248	1.391	.175	1.697	1.804	3.094	.981	1.697
Manufactured consumer goods.....	\$51	\$48	\$54	\$78	\$74	\$77	\$89	\$94	\$91	\$79	\$87	\$92
Percent.....	5.188	4.490	4.843	6.404	5.772	5.355	5.202	4.984	4.437	3.543	3.710	3.395
Furs and pelts.....	\$44	\$41	\$46	\$67	\$56	\$54	\$63	\$55	\$54	\$49	\$46	\$48
Percent.....	4.476	3.835	4.126	5.501	4.369	3.755	3.682	2.916	2.633	2.197	1.962	1.771
Unspecified <sup>1</sup> .....	\$40	\$62	\$75	\$99	\$105	\$144	\$183	\$195	\$285	\$503	\$538	\$482
Percent.....	4.069	5.800	6.728	8.126	6.190	10.014	10.695	10.339	13.896	22.556	22.942	17.786

<sup>1</sup>Largely platinum group metals, nickel, and gem diamonds.

Note: Total U.S. dollar amount, \$53,422,000,000.

In many less developed countries, tourism has made a prominent contribution to foreign exchange earnings. Countries such as Spain have financed a major fraction of their recent economic development in this way. But the Soviet Union appears to lack the necessary infrastructure to support a substantial increase in their foreign exchange earnings from international tourism. As a result, the Soviets are not prepared to exploit a surge of tourism that might result from increased commercial contacts between the United States and the Soviet Union. This avenue appears to be foreclosed in the near future as a substantial earner of foreign exchange to support their increasing demand for foreign technology imports.

#### Soviet Perspectives on Export Potential

The crucial factor which will affect future Soviet trade policy is the current Soviet expectation of long-term U.S. credits and advanced technology; this is expected to help develop the natural resources of Western Siberia, then Eastern Siberia and the Urals region.

Several distinct themes are evident in Soviet pronouncements, indicating the desired direction of future trade patterns:

The Russians want to exploit the natural resources of the permanent frost regions, such as gas, oil and iron ore. Credits are to be repaid with part of the output produced by new enterprises, while at a later stage the U.S.S.R. thinks it will be in a better position to trade with the United States to obtain much needed foreign currency. Thereafter, the Soviet government would be able to procure commodities to improve its general standard of living.\*

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\*V. Spandaryan, U.S.S.R. Gosplan member, "On A Mutually Beneficial Basis," Pravda, 8 May 1973, p. 4.

Soviet trade representatives try to persuade U.S. businessmen that their country is a huge market for American products, but that only the granting of the most-favored-nation clause will contribute to better commercial relations between the two countries.

Commercial transactions between the U.S.S.R. and the U.S., Japan, Western Europe or Eastern Europe might bring about a worldwide market with intertwining links and labor mobility. The four economic superpowers could then cooperate and share the market, but cutthroat competition is not excluded, once Soviet industry is in full swing.

While in the 1950s the U.S.S.R.'s trade with the Comecon countries amounted to almost 90 percent of total Soviet trade, last year it was scaled down to 65 percent. With the exception of East Germany and Czechoslovakia, from which the Russians import industrial products, Soviet trade with the other Comecon countries is more or less a one-way affair: Soviet machinery is exported in exchange for semi-fabricated goods and agricultural products.

East European trade with Western Europe and Japan has shown a steady increase since the early 1960s. As a result of huge U.S. and West European agreements with the Soviet Union and Eastern Europe, the Comecon countries' industrial development will depend more and more on American and West European investment. Japan will also continue to increase its exports to this area. If most-favored-nation status is granted and import duties are lifted, East European countries will be less dependent on the Soviet Union in the mid- and late 1970s. But it is not improbable that once Russia achieves a high degree of economic development in the late 1980s, it may try to reassert economic domination of Eastern Europe.

Energy

The Russians are currently increasing their propaganda about the energy crisis of the Western world. Soviet media make gloomy predictions also about the potential conflict between U.S. oil cartels and the OPEC countries. According to the Russians, the United States is trying to impose on OPEC exorbitant terms by military-political means. Apparently, the Soviets would like to persuade the Western world that the best way to solve the energy crisis is to import fuels from Soviet reserves.\*

Political tension in the Middle East provides the Russians with additional arguments regarding the "safety" of the Soviet political climate and their fidelity to contractual obligations and interstate agreements; this is contrasted to the Arab world's volatile political and economic climate. Moreover, the Soviets are importing oil from the Middle East, possibly hoping that the delivery of Soviet oil to the United States and strained U.S.-Arab relations will force the OPEC countries to sell oil to the U.S.S.R. at a lower price.\*\*

This process could make both the U.S. and Western Europe dependent on a Soviet oil supply; in a political or military crisis, this could prove to be disastrous. On the other hand, the extension of the "Druzhba" oil pipeline and the "Mir" power system for Comecon energy exchange

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\*Sergey Vishnevsky, Pravda, 14 March 1973, p. 3. See also Aviation Week & Space Technology, 28 May 1973.

\*\*According to Soviet sources, in 1972 the U.S.S.R. purchased 4 million tons of oil from Iraq. It also plans to import more than 8 million cubic meters of gas from Iran and an undisclosed amount from Afghanistan. See: G. Skachkov, "Equal Rights and Mutual Benefits," Pravda, 29 March 1973, pp. 4-5.

could aid the process of economic integration between Comecon and the Common Market, and thus create a better market for American products.

#### The Enriched Uranium Market

Another field where Soviet trade patterns may evolve considerably involves selling enriched uranium (U-235) on the world market. It has been projected that by 1977-78, the demand for uranium will exceed the supply. This would be a suitable time for the Russians to enter the world market as a major supplier. One major advantage of selling uranium would be greater foreign currency earnings. The Russians' ability to provide uranium might result in a competition with the AEC, which so far has had a virtual monopoly of the world market. If so, Germany and Japan would be the major customers for Soviet uranium. Additionally, the Soviet Union's entry into the uranium market might contribute to the proliferation of nuclear devices. The Russians have already agreed to conclude contracts for renting radio-isotopes and heavy water. They have concluded an agreement with France for the construction of a European enriched uranium plant. Simultaneously, they have offered enriched uranium to RWE in Essen, with supplies promised to the year 2000.\*

The price of enriched uranium on the world market does not depend on price elasticity alone; other factors are also important. The U.S.S.R. has the advantage of being able to offer lower prices in direct government-to-government transactions, without using middlemen. This advantage could be substantial in competition with the AEC, but some form of duopoly in the uranium market could probably be worked out, provided that no

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\*Paul Wohl, "Soviets Break U.S. Monopoly on Enriched Uranium Sales," Christian Science Monitor, 10 May 1973.

third or fourth seller of enriched uranium emerges, such as South Africa or Brazil.

Soviet reserves of uranium ore are not known exactly, since the U.S.S.R. has not published figures on uranium production, the location of uranium mines or the quality of their reserves. Once the Soviet Union enters the uranium market, the figures should be published. Perhaps Japan, France, Germany or even the United States might be asked for help in prospecting and developing Soviet reserves of uranium. This may depend on whether or not the Russians are prepared to slow down their strategic uranium buildup.

#### Possible Areas of U.S.-Soviet Joint Cooperation

A different aspect of technology transfers is the Soviet desire to:

- 1) develop jointly modern technological processes and equipment;
- 2) move into joint patenting and selling of licenses; and
- 3) participate jointly in the construction of industrial installations in third countries.\*

Joint development of modern technological processes, such as third-generation computers with electronic circuitry or digital tape machines used in the aerospace industry, will not solve the Soviet economic problems. So far the Russians have manufactured three types of computers: the Minsk-32, the ES-1020 and the Nairi 3-1. None of these three types approaches the standard achieved in the U.S., partly because of inherent

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\*V. Alkhimov, Deputy U.S.S.R. Minister for Foreign Trade: "A Useful Step," Pravda, 3 April 1973, p. 4. See also V. Alkhimov, G. Arbatov and N. Inozemtsev, "A Time of Decisions," izvestiya, 5 and 8 May 1973, p. 4.

design problems and an inability to integrate computers into industry, or even to start the planning process for integration. Computers with integrated circuitry and other advanced electronic equipment will not contribute much to an improvement in the popular standard of living; moreover, such equipment could have military applications, especially for ballistic missiles and air defense radars.

Joint patenting and selling of licenses is not likely to bring the United States any early economic or technological benefits, since the Russians have little to offer that had major commercial applications. In exchange for natural resources, the Soviets expect to receive patents and licenses. As long as these cannot be used for strategic-military purposes, the Russians probably will be able to obtain them.

Nevertheless, the transfer of huge complexes and industrial installations would require the presence of American teams of engineers and technicians on Soviet territory. A possible side effect might be the shifting of Soviet engineers now employed in industry to military R & D and weapons production. In this case, the result would be contrary to what is expected.

#### Joint Cooperation and the Third World

Joint participation in the construction of industrial installations in third countries is also a possibility. Here, ideological factors and strategic threats would play a less important role. But common ventures in the Third World would require joint stock companies, similar to Amtorg and operating on entirely new principles. Probably, U.S. corporations would need government backing in order to maintain a profitable relationship with Soviet foreign trade organizations.

Banking and financial operations might be difficult in this case, partly because of competition among American banks to strike profitable relations with the Russians. In addition, the U.S.S.R. does not hold shares in foreign enterprises, and its aid program in the developing world has been aimed at widening the Soviet state economy. According to Russian sources, 70 percent of Soviet credits are earmarked for the expansion of state industry.\*

It should be noted that so far the largest share of Soviet aid resources have been used for the construction of heavy industry enterprises, with more than half of the output being shipped to the U.S.S.R. Thus, the construction of steel mills at Bhilai and Bokara in India, as well as those built in Eastern Europe, have provided an important contribution to the Soviet defense effort.

At this stage it is not clear to what extent the transfer of advanced electronic, computer and avionics technology to the Soviet Union would create a potential competitor for U.S. industry in the long run. Management capacities would also have to be transferred to make it worthwhile for Soviet industry as a whole at the present time.

Agricultural lags, the apathy of the labor force, and an overpowering bureaucratic structure operating on a vertical scale have been the major ills of the Soviet economy. Consequently, the transfer of advanced technology in exchange for natural gas and oil does not seem economically feasible because of the high costs involved. It has been calculated that gas shipped from Russia to New York would cost at least

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\*Vasily Sergeyev, Vice Chairman of the State Committee of the U.S.S.R. for external economic relations, interview, Sovetskaya Rossiya, 17 April 1973.

\$1.50 per thousand cubic feet, for a total investment of \$6 billion or more only in the liquefaction program. At the same time, gas from Texas and Louisiana now costs 70 cents per thousand cubic feet in New York. A fleet of tankers would have to be built, at a cost of at least \$35 billion over the next 25 years.\* A construction program of this size would give a boost to the U.S. shipping industry, but the overall costs are phenomenal.

The Russians will attempt to improve their balance of payments by selling their own products and reducing the amount of credit they owe to the United States. They claim to have achieved success in a number of areas of interest to the American economy:

"Soviet organizations could take part on a reciprocal basis in the creation in the U.S. of enterprises of those sectors where the U.S.S.R. has achieved success: metallurgy, coking, blast-furnace and converter production facilities, installations for continuous steel casting, hydroelectric and thermal electric power stations, construction of high-voltage transmission lines, dams, etc."\*\*

Besides these items, the Soviets have very little to sell to the U.S. with credit or cash. They have expressed a willingness to provide in their economic plans for products which might be saleable in the U.S. market without hurting domestic industries:

"...From this point of view we do not have 'surplus' commodities, but should the American market display interest--and interest is being shown--we could increase the production for export precisely of those commodities in which American purchasers are interested most. At the same time, it would be possible to expand Soviet exports to the United States by

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\*Genrikh Bazhenov, staff member of the USA Institute, Radio Moscow in English to North America, 21 April 1973.

\*\*V. Alkhimov, G. Arbatov, N. Inozemtsev, "A Time of Decisions," Izvestiya, 8 May 1973, p. 4.

introducing some new commodities, making special provisions for their production in the U.S.S.R.'s economic development plans. All this could therefore be done without any damage either to American industry or to third countries" (emphasis is added).\*

Thus, it appears that despite serious shortcomings in labor productivity and agriculture, which in turn have created shortages in consumer goods, the U.S.S.R. is currently eager to acquire advanced computers and electronic equipment. In the long run, provided that its system of management is reorganized along horizontal lines, and joint design and production teams among various industries are established, the Soviet Union could become a competitor for U.S., Japanese and West European industries in the world market.

In the short-run, however, the delivery of industrial equipment may contribute to the enhancement of Soviet strategic systems and military R & D programs. It is also true that U.S. assistance in improving Soviet management methods, labor productivity, and the production of fertilizers and other chemicals could contribute to a general improvement in the Soviet standard of living for its population.

#### Soviet Economic Choices

Any near-term optimism on the Soviet export potential must focus upon their ability to export successfully their extractive industry products, particularly natural gas. The Soviets have shown that they wish to develop an export potential that is more carefully attuned to the immediate needs of their principal Western trading partners. To accomplish this would require a significant change in Soviet methods of

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\*Alkhimov, G. Arbatov, N. Inozemtsev, Izvestiya, 7 May 1973, p. 4.

operation; if successful, this could accelerate Soviet development along the lines of the "export-led" model of Japanese economic development.

The Soviet economy is production-oriented. This results in the well-known maze of industrial and agricultural quotas that are typical of a centrally planned economy. The United States and other Soviet trading partners, on the other hand, are demand-oriented, where production adjusts to the demands of the marketplace. Could one sector of the Soviet economy operate on Western demand-oriented lines, while the remainder of the Soviet economy would operate on traditional production-oriented lines? This is a difficult form of economic organization to envision. Nevertheless, we cannot exclude the possibility of such a hybrid. But some sectors of the Soviet economy would be certain to suffer dislocations in the resource allocation shifts that are an inevitable part of meeting a demand-oriented export market.

To a large extent, the Soviet ability to become a sustainable competitor in the international economy will hinge on its ability to develop such an export-oriented economic hybrid. If the U.S.S.R. is not able to do so, the U.S. Government will be compelled to choose between reducing the aggregate volume of U.S.-Soviet trade to a level which can be sustained by the exports of Soviet extractive industries, or to take a very long-term view of Soviet trade and finance its deficits for many years in the future.

## VI. NATIONAL SECURITY POLICY ISSUES

The national security dimension of U.S.-Soviet technology transfers involves a large number of issues. These issues are primarily economic, and are particularly concerned with the level and composition of trade, and the terms under which U.S.-Soviet trade might occur.

The basic condition is that high levels of Soviet imports can be sustained only if they are financed either by credit from the United States or eventually by the development of Soviet export industries which are internationally competitive. If trade reaches a high level, it would carry its own set of national security implications that would be considerably different from the security implications of trade at relatively low levels. We will indicate in this chapter an embryonic attempt at a net assessment of these economic factors, and some specific policy conclusions concerning technology transfers.

### Soviet Perceptions of the Links Between Trade and Diplomacy

Trade is extremely important in the Soviet view of achieving a new relationship with the United States. The U.S.S.R. made this clear in its statement of "Basic Principles of U.S.-Soviet Relations" which was signed in Moscow in May 1972. The seventh point of the Statement of Basic Principles says:

"The U.S.A. and the U.S.S.R. regard commercial and economic ties as an important and necessary element in the strengthening of their bilateral relations and thus will actively promote the growth of such ties. They will facilitate cooperation between the relevant organizations and enterprises of the two countries and the conclusion of appropriate agreements and contracts, including long-term ones."

Secretary Brezhnev spoke of implementing these trade agreements in an important speech on December 21, 1972, commemorating the 50th anniversary of the formation of the Soviet Union:

"...[We should] lay the foundation for large-scale and long-term cooperation in this sphere. This would at the same time contribute to making the political climate in relations between the U.S.S.R. and the United States more healthy and would facilitate further progress toward the main objective of Soviet foreign policy--lasting peace."

Trade is also seen as having great significance as a "barometer" of the general state of U.S.-Soviet relations (Pravda, March 17, 1973).

Apparently the barometer readings have been favorable enough for the U.S.S.R. to consider that large and long-term trade agreements are desirable and possible. The Soviet Union finds these agreements and their interdependence with the U.S. acceptable because it argues that the U.S. policy has shown "reasonableness," and that this is not a short-term phenomenon, but is based on long-term objective factors. Arbatov argued in Kommunist, No. 3, 1973:

"It is precisely the fact that long-term objective factors are the main reason for the changes which makes it possible to conclude that the trend toward normalization of Soviet-U.S. relations, just like the broader trend toward relaxation of tension and the development of cooperation in the international situation as a whole, has a firm objective basis and, therefore, also a future."

This attitude is quite different from the traditional Soviet attempt to seek maximum security in an autarkic economy. At times, Soviet trade has been used temporarily to shore up a basically autarkic economy. This policy was partly the result of intense feelings of insecurity and vulnerability. It also resulted, though, from the Soviet view that trade was relatively unimportant in solving the major tasks of industrial construction.

The problem today is that of modernizing the Soviet economy and re-establishing its sustained high rates of economic growth. In achieving this goal, foreign trade with non-Communist states is seen as extremely important. Soviet leaders also seem to realize that national or even regional autarky is hardly a realistic ambition in the modern era of dynamic and technological change. Soviet planners seem to have reassessed the role of foreign trade in a more sophisticated perspective, by viewing it not merely as a transitional instrument for self-sufficiency, but rather as a permanent stimulus to economic growth and higher productivity.\*

In a West German television speech, Brezhnev forcefully stated the new Soviet rejection of a policy of autarky:

"I would like to add that our plans are by no means plans designed for autarky. Our course is not toward isolating our country from the outside world. On the contrary, we proceed from the fact that it will develop under conditions of growing cooperation with the outside world, and not only with socialist countries at that but in considerable measure with the States of the opposite social system as well."

Brezhnev's confidence in favorable long-term international trends has been buttressed by Soviet plans for greater economic transactions with the U.S.

Georgi Arbatov, the Director of the Institute of the U.S.A. in the Soviet Union, made clear, at a meeting in February on U.S.-Soviet trade sponsored by the National Association of Manufacturers, that Russia wishes to work out large-scale projects in order to develop its national economy through 1990. Russia wants a more rapid growth of foreign economic ties than even the growth rate of its national income. It states that world standards and the world marketplace will be determining factors more and

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\*See Business International, "Doing Business With the U.S.S.R.," November 1971.

more in planning the output of new Soviet products and the development of new processes. In deciding about investments inside the Soviet Union, the foreign market will increasingly be considered as an alternative focus for production. Arbatov stated:

"We are planning to increase efficiency by improving the technical level of many sectors of the economy, including the processing of raw materials, machine building, management information systems and protection of the environment. This will create great demand for imports. As in the past we believe that imports will continue--more and more--to enrich the assortment of consumer goods and services."

The Soviet Union seems to be looking beyond trade that is limited to the exchange of commodities. It envisions production with Western firms whereby Soviet plants would function as subcontractors, or foreign plants would function as subcontractors to Soviet firms. Specialization of production would be coordinated by process stages and the use of imported parts for Soviet products. This could include joint manufacturing and marketing of products accomplished through joint ventures.

In Soviet eyes, what is the policy which these trade agreements are expected to support? One of the most intriguing expositions of the Soviet peace policy was made by Foreign Minister Gromyko in reviewing a collection of Brezhnev's writings (Kommunist, No. 1, 1973). This review showed the tough side of peaceful coexistence which is rarely discussed in materials aimed for Western readers. Thus a strong defense posture should also be assumed to be an essential part of any Soviet peace program, and we should expect little alteration in military spending as part of detente.

In Soviet discussions, the expense of the arms race is seen as primarily a problem for the United States (see Arbatov in Kommunist, No. 3, 1973). The Russians admit that mutual disarmament would be desirable for

both sides, but they do not admit that the arms race has placed special burdens on the Soviet Union.

Once again the value of Soviet military strength was particularly emphasized by Secretary Ustinov in a speech commemorating Lenin's birthday on April 23, 1973:

"The Communist Party always remembers Lenin's warning on the efforts of imperialism to settle international questions by means of force and does everything essential to strengthen and improve the defense shield of socialism. Thanks to the concern of the party, the Soviet State and the whole people, thanks to the efforts of workers of the defense industry today our valiant armed forces are equipped with the most modern weapons and military equipment....And this as we have more than one occasion to convince ourselves, has a very sobering influence on all kinds of lovers of military adventures. The Soviet armed forces protect our peaceful, creative toil, and the efforts of imperialist and Peking propaganda to spread myths about Soviet military threats are futile."

This speech was delivered one day before the Plenum at which Grechko was elected to the Politburo. Since then, the theme of imperialism's reliance on force has reoccurred in the Soviet military press (Krasnaya Zvezda, April 26 and May 1, 1973). The May 1 Red Star stated that "The imperialist powers are not ceasing the arms race or preparations for war and are increasing their military budgets every year." We suspect that in return for Grechko's accession to the Politburo, there was an understanding that no slackening should be permitted in the U.S.S.R.'s defense effort, even as greater economic and political relations with the West would be developed.

The "peace program" may broaden Russia's scope for maneuver. For example, the Russians have reassured Africans that the U.S.S.R. would use its new relationship with the U.S. to discourage imperialist ventures in

Africa, just as they had used it to encourage the U.S. to end the Vietnamese war.

The use of the peace program to end the Cold War permanently is even seen as benefiting the political activities of Communist parties in Latin America and Western Europe. A commentator in Pravda, April 30, 1973, emphasized that the peace program and greater Soviet prestige would be particularly important in achieving these results. The example of a left-wing coalition in Norway, including the Communist party, was offered as a concrete example of the value of the Soviet program and the Soviet effort to dilute efforts at European unity.

The Soviet Union is also interested in weakening forces in the U.S. which are opposed to improving U.S.-Soviet relations. The peace program and particularly its policies toward the U.S. are seen as bringing forth strong anti-Soviet reactions in the U.S. The Soviet press contains frequent references to "right-wing elements" such as the military-industrial complex, Zionist circles, Senators Henry Jackson and James Buckley, Secretary of Defense Schlesinger, and others. Apparently Russia wishes to use its trade policy and other means of cooperation to encourage the U.S. Government to restrain the most anti-Soviet elements within the American political elite, and to encourage the U.S. Government to exercise self-restraint in other policy areas which are distasteful to the Soviet Union.

The Soviets seem to believe that a long-term strategy of detente will promote their international interest in a number of ways. This would involve reducing their direct confrontation with the U.S. and Western Europe, increasing economic relations to benefit Soviet growth and prestige, maintaining the Soviet military establishment and its growth, particularly in

terms of its global capacities, and maintaining a nationally divided and peaceable Europe, while assisting revolutionary movements in the Third World through military and economic aid and the deterrent value of the Soviet military presence.

This suggests that Soviet leaders, and particularly Leonid Brezhnev, have decided to help create a long-term environment in which manipulative politics would be very feasible. This policy style is compatible with Brezhnev's own internal political style. In the struggles within the Politburo, he has been acknowledged by foreign observers to be very skillful at soothing ruffled feelings and developing consensus at the pinnacle of power within the Kremlin. Brezhnev is also extraordinarily capable in reducing the foundations of the political power of his opponents, as leaders like Shelest and Voronov might attest, and in securing his ends through long-term and patient policies.

In the Soviet perception of expanded U.S.-Soviet commercial relations, a direct linkage to politics is rejected. As was noted earlier, trade is viewed as a means of measuring the state of U.S.-Soviet relations.

The Soviets refuse to describe expanded commercial relations with the United States as the conferring of a benefit or advantage by the United States on the Soviet Union. They retreat instead to a description of the trade as a "mutually beneficial" relationship. This contrasts sharply with the U.S. view, in which we seek to develop a sufficiently high volume of trade to provide the Soviet leadership with a "stake" in the continuity of trade.

Thus, the United States is engaged in the de facto subsidization of U.S.-Soviet trade through trade credits. This reinforces the notion of a

U.S. political interest in such trade: we feel that we seek no direct political benefits from what is, by U.S. calculations, the unambiguous transfer of economic benefits to the Soviet Union from the United States.

At the present time, we lack a fund of historical experience to forecast Soviet behavior toward continued U.S. trade if an intense political crisis between the U.S. and the Soviet Union should arise. But the differences in perceiving the political component of U.S.-Soviet trade make it likely that there will be differences in behavior. The Soviets appear unwilling to forego any important political objective simply for the sake of maintaining their access to imported technology from the United States. The United States, on the other hand, may be willing to accept higher political costs in order to maintain the integrity of U.S.-Soviet detente, particularly to the extent that we believe that expanded commercial relations are at the core of detente.

#### The Procurement of Systems vs. the Procurement of Critical Technology

The most important commercial and scientific-industrial advantage possessed by the United States is its manifest ability to assemble, organize, and operate integrated systems of advanced technology. The United States has been able to exploit its leadership in many fields of science and engineering through its ability to integrate technology subsystems.

Consequently, the greatest "loss" of technology by the United States would be incurred in the process of transmitting to the Soviets entire systems of technology. Proportionately, the transfer of such systems has the greatest impact on the Soviet civilian economy. The importing of entire systems of technology, rather than simple critical subsystems,

permits the Soviet economy to exploit advanced technology to its full potential, rather than suffering losses from an inability to assimilate critical technology subsystems.

For example, in transferring an entire production facility for the manufacture of electronic microcircuits, the Soviets would gain a benefit which is far more significant than the dollar volume of the transaction would imply. Any one of several critical technology subsystems could have been purchased by the Soviets. But they would experience difficulty in integrating such complex subsystems to form a production process which would be an efficient manufacture of electronic microcircuits.

Importing an entire system of technology (on a "turnkey" basis, as is often preferred by the Soviets) would provide a facility which could be immediately employed to enhance the quality of either civilian or military production. At high levels of trade, the problem of suppressing the loss of substantial advanced technology is most severe, because large-scale Soviet imports of technology would become more feasible. Selling complete systems of advanced technology to the Soviets is not a commercial decision; it is a political decision to confer an advantage which could not be reproduced within the Soviet Union, given their existing resources and organizational constraints, at any time in the foreseeable future without wrenching reallocations of resources.

The problem is more complicated in the sale of critical technological subsystems. For many civilian and military applications, successful exploitation depends on the operation of a critical scientific or engineering advance. This requires the integration of appropriate supporting "off-the-shelf" technology.

At low levels of trade, the Soviets will probably seek to procure critical subsystems, rather than entire systems of technology. The U.S. policy problem involved in coping with these critical subsystem exports is somewhat more complex. The Soviets have a limited ability to develop efficient technology systems from imported subsystems. Indeed, it is generally difficult to do the "reverse engineering" necessary to make the most efficient use of a component. As a consequence, the lead times associated with the exploitation of imported technical subsystems may be extensive. This is especially true in the civilian sector, where the Soviets face the problem of embedding advanced Western industrial technology into a primitive industrial base.

While importing critical subsystems may have only a limited effect on the efficiency of the civilian sector, the same may not be true of the Soviet defense sector. Defense industries have a priority in the allocation of personnel, materiel and other resources. Thus, the military sector is more advanced in its ability to assimilate imported technology. U.S. policy choices will therefore be more difficult in dealing with the export of advanced technology that is dual-purpose, namely, that it can be employed in both civilian and military roles.

#### Export Control Policies

Any commercial exchanges with the Soviet Union have a beneficial effect on the Soviet economy. The relevant policy question is the manner in which this Soviet benefit will be treated politically. The U.S. should permit those technology transfers to the Soviet Union which are least likely to degrade the security interests of the United States.

The most conspicuous problem concerns dual-purpose transfers of technology having a significant impact on both the military and civilian sectors. Decisions concerning export controls will be most important. We suggest the following scheme as a technique to modernize export control procedures, in response to recent policy changes concerning trade with the Soviet Union:

1. Critical subsystem technologies should be identified according to their best use for military purposes. For example, an aircraft navigation unit could be applied to civilian aircraft as well as to military aircraft. Its best use, however, would be to provide navigation for long-range strategic aircraft. In the same way, a solid-state mobile FM transmitter-receiver might be used for mobile civil or military communications, but its military best use might be for improving technical communications between combat vehicles.

2. The U.S. Government should establish a priority list of military missions, ranging from those which pose the greatest threat to U.S. security to those that pose the least threat. A representative grouping by priorities might be:

strategic attack systems			
strategic defense systems			
command, control, and communication for strategic forces			
general purpose force firepower			
"	"	"	mobility
"	"	"	intelligence
"	"	"	communication
"	"	"	logistics

3. The military best-use classifications of proposed exports should be compared to the priority list of missions. The most threatening military missions should be associated with technologies which the U.S. should not export, while the least threatening mission should be related to technologies that the U.S. should consider exporting.

It would then be possible to dispense with the unnecessarily rigid criteria of "unique" military applications for exported technology--a criteria which does not measure properly the effect of technology exports on the efficiency of Soviet military systems.

A more reliable guide could be based on a detailed analysis of military missions and the impact which a proposed U.S. technology transfer might have on Soviet military capacities. For example, the U.S. should probably not export an important technology subsystem if it could effect a major improvement in Soviet capabilities in a low-priority mission. Similarly, the U.S. might refuse the transfer of technology which would only have a miniscule effect upon the effectiveness of Soviet performance in a high-priority strategic mission. This scheme would strengthen export controls as they might affect Soviet military missions, without necessarily interfering in routine commercial transactions.

U.S. sales of goods and services embodying advanced technology should reflect several additional considerations. Even if the only application of a technical export would be in the civilian sector, it could still permit the reallocation of some resources so that the most benign transfers can have some military effect. Thus, it is most desirable to encourage sales which have the effect of diverting military resources. Sales which impose a very heavy infrastructure burden on the Soviets consequently

divert manpower and other resources from the defense sector to the civilian infrastructure. These sales may generally reduce the military potential of the Soviet Union as trade increases. This trade policy would maximize the pressure within the U.S.S.R. to employ imported technology for civilian purposes, and diminish the threat to the United States.

#### Threat Reduction Tradeoffs

The transfer of technology always carries some risk that Soviet military potential could be enhanced. This risk can be mitigated when a policy exists for reducing the Soviet threat within a context of greater U.S.-Soviet trade. It is probably not feasible to develop a set of tradeoffs expressing the willingness to transfer certain technology in return for a certain reduction of threat from the Soviet Union. It will probably never become feasible to measure explicitly the impact of large-scale technology transfers on the efficiency of the Soviet military establishment. For example, a large-scale transfer such as the Kama River truck manufacturing facility has such wide effects on the Soviet military and civilian sectors that an accurate understanding of these effects may never be obtained.

This means that in U.S.-Soviet trade, a benefit has been transferred to the Soviet economy which will undoubtedly improve Soviet military strength. The indivisible character of these benefits makes it appropriate for the U.S. to press for some reduction in the threat posed by Soviet military forces as a quid pro quo for the benefits conferred. We have listed below some reductions in the Soviet military threat which might be considered as tradeoffs for high levels of U.S.-Soviet trade:

1. A reduction in deployed strategic nuclear delivery vehicles
2. Fewer men under arms
3. Reduced Soviet deployments of general purpose forces in Eastern Europe
4. Less secrecy surrounding the aggregate strength of Soviet strategic forces
5. Reduced naval construction and deployments
6. Less Soviet-sponsored external subversion
7. A generalized and verifiable reduction in the Soviet level of effort for military purposes.

This list is not exhaustive, but it does indicate the general reductions in military threats and tensions which are intended to be the result of detente.

If the Soviet threat is not mitigated, it would be difficult to develop a trade policy which would prevent the Soviet Union from acquiring significant increments of scientific and industrial improvements to their military establishment, and consequently to the detriment of the United States. The existing U.S. export controls are unlikely to be effective instruments for mitigating these military advantages. Moreover, large-scale trade would reduce the efficacy of these existing controls. By negotiating threat reduction tradeoffs and revising export controls, the U.S. might develop a policy mixture which could mitigate the risks in extensive technology transfers, while maintaining a political framework for improving trade and political relations with the Soviet Union.

APPENDIX A

SOVIET PURCHASES BY COUNTRY AND VOLUME

## SOVIET PURCHASES BY COUNTRY AND VOLUME

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<b>FOOD &amp; BEVERAGES</b>				
26.0	Norway	26.0	Packaged soup plant	Toro Food
11.3	Sweden	11.3	Condensed milk plants	Alfa-Laval
6.16	Italy	6.16	Confectionery equipment	Carie e Montanari SpA
2.81	Germany	2.81	Mineral water bottling lines	Seitz-Asbest-Werke
<b>MINERAL FUELS &amp; RELATED MATERIALS</b>				
<u>Natural Gas</u>				
	France	39.6	Steel tubes--gas indus. equip.	Brun Frères
	France	19.8	Valves--gas industry equip.	Sté Melbranque
77.8	France	18.4	Heavy compressors--gas indus. equipment	Creusot-Loire
9.7	Italy	9.7	Gas & compressor plant	Nuovo Pignone
<u>Petroleum</u>				
71.4	France	71.4	Equipment to oil industry	Venexport Syndicate
	U.S.	20.0	Petroleum production equip.	TRW's Rede
	U.S.	6.0	Oil well pumps	Borg Warner
27.0	U.S.	1.0	Oil well equipment	Geerhart-Owen
<b>CHEMICALS, PETROCHEMICALS, PLASTICS &amp; PHARMACEUTICALS</b>				
	France	28.7	Polyurethane plant	Creusot-Loire
56.5	France	27.8	Polymer sponge plant	ENSA (subsidiary of Creusot-Loire)
54.3	Germany	54.3	Polyethylene plant	Salzgitter Industriebau
	Italy	42.3	Polypropylene & triacetate plants	Montecatini-Edison
50.9	Italy	8.6	Basic chemicals & plastics materials	Montecatini-Edison
	Finland	8.1	Sulphate cellulose plant	Enso-Gutzeit-Trust
	Finland		Sulphate cellulose plant; 4 contracts with:	Tampella Stroemberg Valmet Ahlstroem
27.0		18.9	Total value	
	Japan	15.0	Paraxylol plant equipment	Kanematsu-Gosho
17.5	Japan	2.5	Cable covering compound	Sumitomo, Mitsubishi, Mitsui & Progress Trading Co.

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
	U.K.	4.7	Organic coating line	Redman Heenan
	U.K.	.693	Ultra-pure & pyrogen-free water prod. machines--for research	Elga
6.0	U.K.	.634	Effluent treatment & water recovery plant	Oxy-Effluent Control
3.6	U.S.	3.6	Effluent control systems	Occidental Petroleum
--	Switz.	--	Plastic diecasting automata	Machinenfabrik & Giesserei Netstal
MANUFACTURES CLASSIFIED CHIEFLY BY MATERIAL				
<u>Asbestos Cement Plates</u>				
5.0	Austria	5.0	Asbestos cement plate plants	J.M. Volth
<u>Kitchen Cabinets</u>				
6.5	Germany	6.5	Kitchen cabinet factory	Bison-Werke, Bähre & Greten
<u>Iron &amp; Steel</u>				
	France	25.7	Seamless pipes	Lorrain-Escaut et Vallourec Reunies
61.3	France	35.6	Welded tubes--3 contracts with:	Comptoir France-Belge
	U.K.	13.5	Steel plant, construction of	British Screw Co.
	U.K.	11.2	Iron ore pelletizing plant	Ashmore, Benson, Pease & Co.
	U.K.	5.86	Coated steel strip plant	Redman-Heenan
	U.K.	5.86	Coated steel strip plant	H.H. Robertson
	U.K.	4.7	Extension of Soviet coated steel plant	Redman-Heenan
	U.K.	2.35	Coated steel strip plant	Simon-Carves
	U.K.	1.69	Continuous bar induction heaters	GKN Birwelco
45.63	U.K.	.47	Paint tech for coil coating lines	Berger Paints
	Germany	--	Steel plant, construction of	Salzgitter & Korf
	Germany	20.1	Automation system for "2000" strip mill	Siemens
22.53 (2/3)	Germany	2.42	Automated unit for vacuum treatment of liquid steel	Standard Messo
<u>Leather</u>				
4.84	Germany	4.84	Leather valise factory	Sotema

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<u>Metalworking &amp; processing</u>				
12.0	U.S.	12.0	Coil coating technology	Prefinish Metals
5.6	France	5.6	Construction of aluminum plant	Aluminum Français
5.0	Switz.	5.0	Furniture hinges factory	Egli
.94	U.K.	.94	High-speed metal decorating lines	Weilman Engineering
--	Germany	"world's largest"	Aluminum bar extruding press	Roehling-Burbach
--	Sweden	--	Hot-working press for forming low-malleable metals	ASEA
<u>Textiles</u>				
	U.K.	94.0	Polyester fiber plant	Polyspinners syndicate
95.93	U.K.	1.93	Carpet machinery	Edgar Pickering
	Germany	23.1	Household textiles production line	Industriewerke Karlsruhe Augsburg
	Germany	20.15	DMT production equipment (for polyester production)	Krupp-Werke
	Germany	10.6	Down & feather processing mach.	Conrad Engelke
	Germany	8.43	Down & feather processing mach.	Conrad Engelke
62.28 (4/5)	Germany	--	Polyester fiber plant	Friedrich Uhde
	Japan	11.0	Worsted yarn	---
17.0	Japan	6.0	Spinning machines	Howa
15.8	France	15.8	Equip. for modernization of textile works	Schlumberger et Cie
3.38	Finland	3.38	Men's clothing	Fexima
.21	Sweden	.21	Screen printing machines	Svecia Slikscreen Maskiner
--	U.S.	--	Cotton processing units	Platt-Lumbers
<u>Pulp Paper</u>				
7.35	Austria	7.35	High quality office paper plant	J.M. Voith
4.5	Japan	4.5	Semiconductor paper production line & other equipment	Wako Koeki

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<u>Rubber Products</u>				
10.3	U.S.	10.3	Equipment for drying & packing synthetic rubber	Anderson
.135	U.K.	.135	Radial tires	Dunlop-Pirelli
.0043	Italy	.0043	Machinery to make automobile rubber accessories	Pirelli
<u>Wood Products</u>				
	Finland	38.7	Chip board production plants	Vaimet OY
	Finland	--	Chip board plants	Rauma-Rapola
38.7 (1/3)	Finland	--	Production line for veneer for facing chip boards	Lahden Rautateollisuus
<u>NONELECTRIC MACHINERY</u>				
<u>Agricultural Machinery</u>				
1.34	Denmark	1.34	Seed pelletizing plant	Danske Sukkerfabrikker
.705	U.K.	.705	Solvent extraction plant to process fermentation product for protein meal	Rosa, Downs & Thompson
--	Italy	--	Combined fodder plant	GIZA
--	Italy	--	Reconstituted milk plant	GIZA
--	Germany	--	Air-screen production facility	Bosch
<u>Construction</u>				
--	Austria	--	Prefabricated panel house plant	Zuckermann KG
<u>Mining</u>				
.67	Germany	--	Auxiliary equip for stripping units	Demag-Lauchhammer & Orenstein-Koppel
<u>Hydraulic Equipment</u>				
--	Germany	--	Sandstone pressing plants	Krupp Maschinenfabriken
<u>Machine Tools</u>				
5.95	France	5.95	Boring & turning lathes	CNMP Berthiez
	U.S.	"multi-million"	Machine tools	Lear Siegler
"multi-million"	U.S.	.45	Calcinating kiln, devices for producing grinding mixtures	Norton
1.21	Sweden	1.21	Polishing & grinding devices	Ulvunde Verkstader

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<u>Machine Tools (cont'd.)</u>				
1.175	U.K.	1.175	Drilling machines	Vero Electronics
--	Germany	--	Boring & turning lathes	Gildemeister
<u>Printing</u>				
.82	U.S.	.82	Offset printing machines	Rotaprint
<u>ELECTRIC MACHINERY &amp; APPARATUS</u>				
<u>Business Machines</u>				
1.34	France	1.34	Automated stock control system	Honeywell-Bull
1.0	Italy	1.0	Calculating machines	Olivetti
--	U.S.	--	Cash registers	Natl Cash Register
<u>Communications &amp; Telecommunications</u>				
	France	1.98	Airline passenger info system	CGCT
	France	1.68	Telex communication "Data System DS4"	CGCT
	France	1.19	Telex communication "Data System DS4"	CGCT
6.04	France	1.19	Electronic switchboard for Data System DS4	CGCT
	U.S.	1.34	Satellite communication--transmitting & receiving facilities	ITT
	U.S.	1.0	Transmitting & receiving facilities	ITT
.6	Japan	.6	Satellite communication ground stations	Nippon Electric
<u>Computers</u>				
2.38	France	2.38	Numerical control equip	CIT-ALCATEL
1.08	U.K.	1.08	EDP system 4170	ICL
	U.S.	--	Computerized translation services	Logos Development & Swindell Dressler
<u>Precision Instruments &amp; Electronics</u>				
	U.S.	2.25	Radio-controlled activators	Honeywell
3.05	U.S.	.8	Computer-controlled fermentation system	New Brunswick Scientific Co.
1.98	France	1.98	Electrical insulator factory	Permali & Secrete

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<u>Precision Instruments &amp; Electronics (cont'd.)</u>				
	U.K.	.7	Heat exchangers for photo-graphic industry	A. Johnson & Co.
	U.K.	.58	Materials' testing & metals' analysis	Instrom Ltd.
1.68	U.K.	.4	Conradl digimeters	Survey & General Instrument Co.
1.21	Austria	1.21	Automatic installations for steel tubes	Schlimberger
1.02	Finland	1.02	Pulse Analyzers	OY NOKIA AB
.455	Japan	.455	Electronic cardiographs & gastroscopes	Iskra
<u>Electric Machinery &amp; Equipment</u>				
15.0	U.S.	15.0	Electric arc furnaces	Swindell-Oressler
	U.K.	1.17	Transformer testing equipment	Ferranti
1.77	U.K.	.6	Polishing machines	Brookes-Tube Investment Group
<u>TRANSPORT EQUIPMENT</u>				
<u>Automotive</u>				
	Germany	219.0	Truck gear-making equipment	Liebherr Verzahntechnik
	Germany	125.0	Truck transmission mach tools	Liebherr Verzahntechnik
	Germany	2.19	Filters for engine & gear prod.	Sack
	Germany	1.03	Crankshaft production lines	Rheinstahl
347.75	Germany	.53	Differential casings plant	Mausier-Schaefer
	U.S.	68.0	Construction crawler tractors	Caterpillar
	U.S.	40.0	Construction crawler tractors	Intl Harvester
	U.S.	30.0	Moulding machines	Combustion Engineering
	U.S.	22.7	Machine tools & automatic lines for engine cylinder block prod.	Ingersoll Rand
	U.S.	20.0	Automated line for forged truck parts	E.W. Bliss
	U.S.	20.0	Machine brake drum tools	Cross Co.
	U.S.	16.0	Rear axle production equip.	Gleason
	U.S.	10.0	Shot-blasting machines	Carborundum
	U.S.	--	Transfer lines for engine pistons	La Salle Machine Tool
	U.S.	--	Moulding machines	Se-Kast
	U.S.	--	Crankshafts, engine & frame components	Warner & Swasey Co.
226.0 (8/12)	U.S.	--	Brake-drum & wheel hub prod. line	Cross Co.

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<u>Automobiles (cont'd.)</u>				
49.9	France	39.6	Transfer lines & painting equip.	Renault
	France	8.12	Cylinder coating factory	Renault
	France	2.18	Automatic presses	Sonocom
28.0	U.K.	18.8	Pretreatment & painting lines	Haden Carrier
	U.K.	3.17	Vehicle silencer prod. line	Moon Brothers
	U.K.	2.94	Automatic line for brake shoes	Girling
	U.K.	1.17	Air brake cylinders prod. line	Federal Weider & Machine Co.
	U.K.	1.17	Machine tools for low-pressure diecasting foundry	DYMO
	U.K.	.435	Component assembly machines, equip. for testing tanks	Moon Brothers
	U.K.	.317	Transformer parts transporter	Crane Fruehauf Trailers
	U.K.			
7.2	Japan	7.0	Car chassis production line	Komatsu
	Japan	.2	Machines to produce rods	Naniwa
6.18	Netherlands	6.18	Tractor cabin welding & pressing plant	Steelweid Ambal
2.54	Italy	2.54	Equip. for spare parts whse.	FATA
<u>Materials Handling</u>				
13.4	U.S.	13.4	Truck conveyor system	Webb Corp.
6.25	Germany	6.25	Truck conveyor system	Mannesman Giesel
1.48	Sweden	1.48	Refuse suction & laundry conveyor system	Svenska Flaekfabriken
<u>Shipping, Shipbuilding</u>				
39.77	Japan	33.27	Timber carryiny vessels	Hitachi Shipbuilding Co.
	Japan	6.5	Freighters	Hitachi Shipbuilding Co.
24.67	Netherlands	22.2	Dredgers, pipe-laying & pipe-covering machines	IHC
	Netherlands	2.47	Dredger	IHC
<u>Transport Equipment</u>				
6.7	Japan	6.7	Port-loading facilities	Mitsui & Co. & Mitsui Shipbuilding
5.0	U.S.	5.0	Heat-treating furnace lines	Thermo Electron Corp.
<u>Aerospace</u>				
--	U.S.	--	Airplane door-latching device	Boeing

TOTAL KNOWN VOL. IN \$ MIL.	COUNTRY	VOL. IN \$ MIL.	PURCHASE	FIRM
<b>MISCELLANEOUS MANUFACTURED ARTICLES</b>				
<u>Packaging</u>				
26.0	Norway	26.0	Mfg. equip. for aluminum bands for food packaging	Nordisk Aluminumdustry
3-5	U.S.	2.0	Sea containers	Interpool
	U.S.	1-3	Sea containers	Container Transport Int'l
	U.K.	1.76	Sea Containers	Sea Containers
2.465 (2/3)	U.K.	.705	Wax-moulding plant	J.W.K. Greer
	U.K.	--	Toothpaste tube-filling prod. line	Aranco-Alita
6.05	Switzerland	6.05	Perfume box mfg. equip.	Egli
.242	Sweden	.242	Cardboard containers	Sunds
<u>Miscellaneous</u>				
7.13	France	7.13	Spectacle glass & lenses prod. facilities	CMV
	Italy	--	Toothpaste mfg. plant	Prassindustria
<b>GRAIN</b>				
1,000.0	U.S.	1,000.0	18 million tons of grain	Continental Grain Co. Louis Dreyfuss Corp. Cargill, Inc. Cook Industries, Inc. Bunge Corp. Garnac Grain
380.0	Canada	380.0	5 million tons of grain	--
59.5	France	59.5	Barley & wheat	Government

APPENDIX B

SCIENTIFIC AND INDUSTRIAL COOPERATION AGREEMENTS

## APPENDIX B

## SCIENTIFIC AND INDUSTRIAL COOPERATION AGREEMENTS

AGREEMENT	SIGNATORY	INDUSTRIAL COOPERATION				SCIENTIFIC TECH. COOP.				
		LICENSE IN RE- SULTANT PRODUCT	PLANT IN OTHER GOODS	TECH. IN UNKNOWN METHOD	CO-PROD- UCTION	JOINT R&D	EXCH. INFO	EXCH. PER- SONNEL	GEN- ERAL	POSSIBLE INDUSTRIAL COOPERATION
<u>UNITED STATES</u>										
FOOD & BEVERAGES Pepsico bottling			X							
MINERAL FUEL & RELATED MATERIALS										
Natural gas exploi- tation--equip & tech	Cooper Industries			X				X		
Natural gas exploi- tation--equip & tech	El Paso; Occi- dental Petro.	X								
Natural gas exploi- tation--equip & tech	Tenneco; Texas E. Transmission; Brown & Root	X								
CHEMICALS, PETROCHEMICALS, PLASTICS & PHARMACEUTICALS										
Ortho- & paraxylene production--tech.	Arco Chemical			X				X		
Abrasive materials-- plant & technology	Norton			X						
Lacquers & resin	Reichold Chem.				X					
Fertilizer complex-- equip. & Tech.	Occidental Petroleum	X	X							
Isocyanate plant--tech	Upjohn			X						
MANUFACTURES										
Chemical treatment of steel strip (see U.K.)	Rohr Amchem; H.H. Robertson			X						
Metal finishing	Occidental Pet.		X							
Metal finishing	Occidental Pet.		X							
NONELECTRIC MACHINERY										
Mining equipment & processing units	Joy Mfg.						X		X	
Steam, gas, nuclear power generation	G.E.					X	X	X	X	X
ELECTRIC MACHINERY										
Air traffic control	U.S. F.A.A.								X	
Data exchange-- computer engineering	Control Data					X	X		X	X
Medical electronics, small computers, measuring instruments	Hewlett- Packard				X	X		X	X	
TRANSPORT EQUIPMENT										
Bicycle & motorcycle equip.	Bata	X								
Gas & oil trans.	Brown & Root						X		X	X
Contracts to link sea container routes	Interpool			X						
Jt. manned space mission								X	X	
MISCELLANEOUS MANUFACTURES										
Container & packaging tech.	American Can						X	X	X	X
Tableware factory equip	Alliance Tool & Die; Atlas Fabricators			X						
Advertising	Marsteller, Inc.	X								

AGREEMENT	SIGNATORY	INDUSTRIAL COOPERATION				SCIENTIFIC TECH. COOP.				
		LICENSE, IN RE-SULTANT PRODUCT	PLANT, IN OTHER GOODS	TECH. PD, IN UNKNOWN METHOD	CO-PROD- UCTION;	JOINT R&D	EXCH. INFO	EXCH. PER- SONNEL	GEN- ERAL	POSSIBLE INDUSTRIAL COOPERATION
<b>GERMANY</b>										
CHEMICALS, PETROCHEMICALS PLASTICS & PHARMACEUTICALS Plastics, dyestuffs, fuels, mineral oil edditives	BASF					X			X	
Detergent plant	Henkel			X						
Pigments, plastics, syn- thetic rubber, lacquers	Bayer						X		X	X
Photochemistry (see Belgium)	Agfa-Gevaert					X			X	
MANUFACTURES Continuous casting method	Friedrich Krupp					X	X	X	X	X
Aluminum cold-rolling mill	Siegener Maschinenbau			X						
NONELECTRIC MACHINERY Mining equipment & processing units	Ruhrkohle					X	X		X	X
Axial bellows for power station cauldrons	Kuhnle, Kopp & Kausch			X						
Machine tools & metal working machines	Werkzeugmaschinen Fabrik Gildemeister					X	X	X	X	X
Machine tools	Pres. Machine Tools Mfg. Assoc.					X			X	X
ELECTRIC MACHINERY & APPARATUS Communication, data processing, electrical engines & tools	AEG-Telefunken						X	X	X	X
Air preheaters for power stations	Kraftanlagen of Heidelberg			X						
TRANSPORT EQUIPMENT R&D for safety, town transport, pollution	Daimler-Benz			X		X	X		X	
<b>UNITED KINGDOM</b>										
CHEMICALS, PETROCHEMICALS PLASTICS & PHARMACEUTICALS Chloroprene monomer plant	Power-Gas			X						
High-solid latex plant	CJB (Projects)			X						
Pharmaceuticals--mainly antibiotics	Beecham Group					X	X	X	X	X
MANUFACTURES Chemical treatment of steel strip (see U.S.)	Simon Engineering Redman B&K Ltd; Berger Paints			X						
Auto tires (see Italy)	Dunlop					X	X		X	
ELECTRIC MACHINERY Copying machines	Rank-Xerox					X	X	X	X	X

AGREEMENT	SIGNATORY	INDUSTRIAL COOPERATION				SCIENTIFIC TECH. COOP.				
		LICENSE, IN RE- SULTANT PRODUCT	PLANT, IN OTHER GOODS	TECH. PD. IN UNKNOWN METHOD	CO-PROD- UCTION,	JOINT R&D	EXCH. INFO	EXCH. PER- SONNEL	GEN- ERAL	POSSIBLE INDUSTRIAL COOPERATION
<u>FRANCE</u>										
MANUFACTURES Stainless steel & sil- icon steel rolling mills	Flves Lille Cail; Jeumont-Schneider			X						
Nonferrous metallurgy	Treflmeteux; Minemet; Pechiney					X			X	
MISCELLANEOUS MANUFACTURES Microperfs & integrated circuits for watches	Lip				X					
<u>ITALY</u>										
CHEMICALS, PETROCHEMICALS, PLASTICS & PHARMACEUTICALS Electrolysis zinc removal machines	Montecatini- Edison			X						
Chemical plants	ENI	X				X			X	
MANUFACTURES Auto tires (see U.K.)	Pirelli					X	X		X	
<u>BELGIUM</u>										
CHEMICALS, PETROCHEMICALS, PLASTICS & PHARMACEUTICALS Photochemistry (see Germany)	Agfa-Gevaert					X			X	
MANUFACTURES Looms	Picenol					X	X	X	X	
Textile machinery	Picenol					X	X	X	X	
<u>JAPAN</u>										
MANUFACTURES Wood chips & wood processing equip.	Nihon Chip Boeki	X								
<u>NETHERLANDS</u>										
CHEMICALS, PETROCHEMICALS, PLASTICS & PHARMACEUTICALS Yarns, fibers, chemicals & pharmaceuticals	AKZO NV	X	X						X	

APPENDIX C

U.S.-SOVIET TECHNOLOGY TRANSFER  
SEMINARS: A DIGEST

APPENDIX C

U.S.-SOVIET TECHNOLOGY TRANSFER  
SEMINARS: A DIGEST

By

David P. Harmon, Jr.

INTRODUCTION

This paper represents a digest containing the salient points of three meetings held with academicians and Sovietologists, businessmen, and bankers respectively for the purpose of exploring the feasibility of large scale, high level transfer of technology from the United States to the Soviet Union, trade gains which might accrue to both countries, and the problems inherent in future large scale commercial dealings with the Soviets.

The following principal questions were examined:

1. The adequacy of the Soviet economic infrastructure to absorb high level, expensive technology in order to be able to generate export income?
2. Are U.S. and Soviet organizational and institutional arrangements adequate to support the kind (and level) of trade foreseen?
3. What sort of imports are the Soviets looking for?
4. What and how much are the Soviets going to export?
5. How adequate are financial arrangements and payments mechanisms for a high level of technology transfer and trade?

The U.S. position appears to call for a long-term, sustainable trading relationship as an important element in the maintenance of friendly relations

In the future:

"We have a long-term and permanent interest and just from the political side a phrase that is frequently used is that the existence of large-scale, permanent trading relationships presents each side with another reason why they should not allow a political conflict or political crisis to become so serious that either side feels it must go to the mat on that particular subject."

Thus, the real economic expectations must be well understood in order to permit accurate tailoring of political expectations. If the U.S. makes large political concessions to the Soviets and then finds them unable to absorb technology, unable to pay for it and unable to sustain a long-term, mutually beneficial trading relationship, damaging domestic U.S. political repercussions are a strong possibility. In the face of potential failure, it will be difficult to convince the U.S. citizen of the necessity of such a relationship.

On the positive side, in the near and medium term, it is likely that we shall be selling the Soviets "off-the-shelf" technology at relatively low commercial risk thus providing them with a base of brand new equipment, which if correctly used, will help their economic development. Further, it is hoped that, for the long-term, technology transfer will be of a dynamic nature, i.e., the Soviets need for new U.S. technology will continue rather than taper off.

## WHAT THE RUSSIANS WANT

"Would you expect them to be short term in the sense that they are associating technology with fixing bottlenecks, or perhaps do you get an impression that they are looking for a way of importing technology that will really reduce the cost of production so that they can have a least cost combination of inputs to have a most efficient production scheme, or will they try to develop a trade just long enough to get their own industrial sector shaped up so that they can again go back to being an autarchic society and completely independent...and then they don't trade with us again for 20 years until they need some technology again."

In furthering their own economic development, the Soviets are looking to the West for the transfer of many aspects of high-level technology. U.S. strength in technology lies in the linking of basic research with development and the incorporation of research and development into the business decision-making process. Thus, the principal aspects they seek include:

- a. Improvements in technological (including production) processes, e.g., better steel--via better organization of production, as well as different approaches to production.
- b. Mechanization and automation of the production process.
- c. Management of labor resources, e.g., shifting them from one sector to another.
- d. High level managerial and decision-making skills (including criteria for making those decisions).
- e. Organization of firms--organizational shifts.
- f. Management methods and techniques.
- g. Managerial and business philosophy.

From the standpoint of the Soviet economic planner, the main issue is the translation of this transfer into reality. While the planner recognizes that there is a vital need for these new concepts, he is faced with biases

for economic centralization, acquisition of embodied technology as a means of obtaining technological progress and a fear of instituting what would be considered dramatic changes in the system, for example, decentralized decision-making at the firm level.

In order to attain improved decision-making the Soviets announced (at the end of 1970) a plan to restructure their "institutional arrangements" such that the "means of production" would be linked with research institutes, testing-facilities and design bureaus. Such a scheme would logically tie research to development resulting in a smooth, break-free flow from concept to product.

Given the political constraints which the Soviets face, it is certain that they will be selective in choosing those areas of technology (new, advanced technology as opposed to consumer goods technology) which will benefit their system (as they see it). Priorities will play a large role in what is selected as was noted by a large U.S. computer manufacturer:

"We have in fact, just to give you numbers recently released, installed to date 52 computers in the Soviet Union. I compare that to the IBM basis for the heck of it because they are so much bigger than we are, everywhere in the world. They've got one computer in the Soviet Union; I guess they haven't tried too hard to sell them there. But we've got a large number of machines there. We've done business in excess of \$100 million in the Eastern countries, so we've got a relatively successful business there and we've been able to finance it and we've been able to get hard currency for that we've sold, so far."

From the U.S. standpoint, Dr. Woroniak raised the key issue:

"...what can we and should we (considering our own interests) do for them and how are they going to pay for it."

THE IMPACT OF WESTERN TECHNOLOGY  
ON THE SOVIET SYSTEM

The Soviet leadership recognizes that contact with the U.S. in the 1930s and 1940s (NEP program, food relief missions, World War II aid) has had an impact on the Soviet people. The central problem for the leadership is how to absorb Western technology without the Soviet people absorbing Western values, etc.

Insofar as future technological transfer is concerned, two opinions surfaced at the conferences. The first opinion held that the Soviet leadership has a basic problem--how to absorb Western technology with large numbers of American technical personnel coming into contact with the Russian people and at the same time not absorb the "unpleasant" by-products of contact with Western values, business requirements, etc. The other opinion held that the leadership recognizes that they will have to pay the price for what they want, for example, permitting foreign ownership in joint ventures, allowing repatriation of profits and recoupment of initial investments. At the same time, the Soviets will present themselves as a strong partner in joint ventures and will act to minimize contact between foreigners and the Russian people.

## THE TRANSFER OF TECHNOLOGY--VARIOUS AREAS

In examining the areas in which technology transfer may be feasible, it is necessary to look for products/processes/technologies the Soviet Union can export in order to earn the foreign exchange to pay for the transfer, or simply, where does the U.S.S.R. have comparative advantage. In the search for Soviet areas of comparative advantage, certain facts and general limitations came to light, viz:

1. In the areas of complex technologies, the Soviet Union suffers from lack of service capability, ready availability of spare parts, sufficient variety of models, high product quality, design, and scheduling expertise. On the other hand, the Soviets are exploring the entry of foreign markets where spare parts, service etc. must be provided. They are looking to various Western European corporations as possible distributors for their goods.

2. A general lack of marketing expertise

3. The Soviet Union probably would be better off exporting "normal" ("lower"-technology) industrial products. Currently, the Soviets export inexpensive television sets, transistor radios, watches, etc. to Africa and the Middle East--but hard currency is not generated.

4. It is difficult for the U.S. businessman to determine what to charge for technology especially in light of the feeling that Soviet goods are not worth much.

PROBLEMS THE SOVIETS AND THE U.S. FACE IN THE TRANSFER OF  
TECHNOLOGY FROM THE WEST

It has been assumed that it is in both the United States' and Soviet Union's interest to increase trade; that we have much they want to buy from us; and that we should consider ways to help the Soviets reduce costs so that their products will be attractive to us.

From the three conferences which form the basis of this digest the most persistent theme has been the number and magnitude of the problems the Soviets and the United States face with respect to any large scale transfer of technology.

The chief problem is the Soviet Union's inability to absorb imported technology from the standpoint of costs which their system may have to pay both in terms of building economic infrastructure and in terms of exposure to and possible acceptance of portions of Western economic/business "Ideology." As a starting point it appears that while the Soviet Union is better organized (via the U.S.S.R. Academy of Science) than the United States in the sphere of basic research, they have real difficulty in applying the results of that research. The difficulty stems in part from a basic conflict between the State Committee's goal of introducing innovations into Soviet industry and the plant managers' objective of meeting annual production quotas. Recognizing this problem, the Soviets are attempting to alter their pricing system so as to provide for incentive to close the gap between the self-interest of plant managers and the preferences of government planners.

In addition, the Soviet economic system, while it is able to progress rapidly in selected, high priority areas, lacks the ability to change

priorities rapidly and thereby shift the system to meet new problems or needs. This inflexibility, coupled with lack of infrastructure, leaves the Soviet Union much in position of an underdeveloped country--unable to absorb technology.

Further obstacles to technology absorption abound, viz:

A. The Soviet's preoccupation with military matters (China, West Germany, Eastern Europe, and the buildup of its navy) withholds resources necessary to economic development. A MBFR agreement in Europe could remove up to 50 percent of the perceived threat and thereby free up resources to be allocated between the remaining strategic needs and new domestic requirements.

B. While the Soviets have approved areas for joint research, there is a general Soviet unwillingness to divulge necessary economic and business information such as prices, cost structures and ability to repay debts. Also the Soviets are unwilling to permit large scale interchange of scientists, engineers and technical personnel (particularly U.S. to U.S.S.R.), as well as to allow potential Western "partners" to visit areas of interest such as Siberia for the purpose of making their own business estimates. A prime example of the lack of openness on the part of the Soviets is given by the Swindell-Dressler/Kama River foundry case wherein a constant stream of Soviet specialists spend six to eight months in Pittsburgh familiarizing themselves with U.S. equipment and its installation while no American has yet to set foot in the Kama River installation. Without such basic information and a degree of openness, it is hard to see how banks could justify loans or businesses commit resources to joint undertakings in the Soviet Union. A consensus existed among the businessmen that in general the data which is furnished

is inadequate, unsophisticated and that the type of data needed may well be unavailable. Part of the data problem stems from the fact that the Soviet cost accounting system differs from that of the U.S. not only in recognition of cost items, but also in terms of cost principles. In addition, data is only divulged on a case-by-case, deal-by-deal basis with the "burden of proof" as to why the information must be known on the U.S. businessman. Only when the Soviets have sufficiently high priority needs do they willingly furnish data.

The bankers' complaint centered about the lack of data on currency and gold reserves, i.e., as one of the primary Soviet "payment-vehicles" for projects. In addition, cash flow projections for proposed projects are non-existent.

C. To what extent and how will the transfer of technology be accepted by the next leaders of the Soviet Union?

D. In the past, the Soviet Union has been able to stress military and heavy industry development by keeping the standard of living low. The Soviet citizen was willing to blame his poor condition on World War II, however, he now is less willing to do so and the question arises of how much "cushion" is left in the Soviet Union to permit, for example, diversion of resources to a large "Siberian push?"

E. The halt in operation of black, kolkhoz and free markets has hurt in that these markets acted as anti-inflationary devices and sopped up purchasing power. Purchasing power is currently building as is evidenced by large increases in savings. It appears that automobiles and meat are the easiest ways to absorb this excess of purchasing power and at the same time provide real incentive for workers to increase their productivity.

Yet, if the Soviets opt for meat and automobiles (and oil), it will be incumbent upon them to add more of their own resources and energies in order to truly benefit from technology imported from the West.

F. The inability of the Soviets to meet Western product quality standards.

G. Reliance on the "turn-key" concept:

"Here you have the real nub of the potential pitfall that American business is going to face in my view and that is the Soviet concept of the turn-key operation. That is the biggest trap that is sitting here unbeknownst to many American firms who are going over there. The Soviets would love to have you quote anything in turn-key, because what that means is you come in and you don't leave until you fix it and they don't pay the last 20 percent. You don't buy out until you have that thing running, and running by Soviet standards, which are just incomprehensible by way of American standards."

- U.S. businessman

H. Businessmen feel that the Soviet institutional framework is weighted toward dealing only with largest of U.S. firms since Soviet economic philosophy is basically opposed to dealing with the small firm-- in that they just don't know how to do it nor do they understand what an entrepreneur is and how to deal with one. Nor is the small U.S. firm adept at dealing with the Soviets due to lack of funds, personnel and experience in protracted, often-times difficult negotiations.

Additionally Soviet needs are so large for technology and supportive infrastructure that they are dealing only with large firms, and want consortiums in order to draw the necessary large scale financing.

I. The concern that Soviet fear of political repercussions stemming from involvement with capitalist countries will severely limit what they will purchase and thereby make the Soviet Union even less attractive as a market.

J. Without U.S. or Japanese technological assistance the Soviets will find it extremely difficult to exploit their petroleum resources and thus will have to look even harder at what they will have to sacrifice in order to finance desired imports. Even so, from the Soviet viewpoint, the marginal benefits of such sacrifices may outweigh the costs.

K. Although the Soviets' internal pay scale is low relative to ours, the U.S. cannot count on "cheap" Soviet labor to reduce the price of exportables since the Soviets treat labor in same manner as they do exportable commodities. Further, the Soviets experience a high degree of "frictional" unemployment. One-fifth of the engineers in Moscow change jobs each year, while manpower in small urban areas and national minorities are underutilized.

L. Technology transfer is unlikely to bring about economic reform in the Soviet Union--the West's overemphasis on Soviet economic "reform" in 1964-1965 should be remembered.

M. U.S. labor is very likely to be opposed (as indicated by Peter Flanigan's testimony before the Senate Finance Committee) to the long-term deals and preferential trade arrangements desired by the Soviets, since we can sell them "off-the-shelf" technology, and have the "systems" expertise to build plants and produce cheaply all with Soviet labor. In effect, we sell them the technology and they pay for that technology with the output of the resultant plants.

Another problem area is that of financing U.S.-Soviet deals, viz: If loans are granted the Soviet Union at rates substantially lower than those offered the U.S. businessman, U.S. labor will oppose such low-cost loans on the grounds that there are American businessmen willing to build plants in the U.S. and employ American labor. Effective "subsidization" of U.S.-Soviet

technology transfer by the Ex-Im and commercial banks will appear to U.S. labor as an extension of the Mexican border industrialization program wherein U.S. affiliates are set up outside U.S. borders to avail themselves of cheaper labor and that labor cannot be organized.

N. On the American side, a need for a degree of sensitivity and patience in dealing with the Soviets. Some businessmen appear to be understanding of the Soviet's problems, but at the same time are somewhat exasperated:

"They'll take our computers and let them stand out in the snow for three weeks because the guy wasn't scheduled to take it off the docks until next Monday. But they don't care. It could cost a million dollars. The workman doesn't know and it stays there. And so they come back. 'Do you need another one?' and they pay for it."

O. Finally, the U.S. business community has experienced a lack of reciprocity in the way the Soviets do business with the West, as well as a "ruthless" playing off of competitors for their business.

It should be noted that we have a predilection to see only their problems, while what they do right is somewhat ignored. In fact the Soviet Union enjoys a \$500-600 billion economy, very few people go hungry, and things get done.

The type of U.S.-Soviet deals that are under consideration are long-term in nature running from twenty to forty years, and it is foreseen that the initial ten to twenty years of production will pay for the facilities while from the remaining 10-20 years of production a portion will be earmarked for the U.S. firm to market in the West. From this long-term relationship should come a series of marketing and technological interdependencies valuable to both sides. In addition, it appears incumbent upon U.S. business to guide the Soviets in accepting only the technology

they can reasonably absorb in order to avoid the risk of U.S. business gearing up to meet a potential market--only to find the U.S.S.R. unable to absorb the technology and having used up its foreign exchange.

In order to ease the problems of doing business, the Soviet Union is suggesting the creation of a joint U.S.-Soviet Chamber of Commerce, which coupled with U.S. Department of Commerce assistance (Bureau of East-West trade) should assist in speeding up contract negotiations and conclusions, help the small businessman in his dealings, and in general provide information and contacts for U.S. businessmen wishing to do similar types of business in the Soviet Union.

The creation of industry-wide committees was suggested as a means of organizing negotiation infrastructure in order to avoid the current duplication of effort which is necessary every time a new company enters negotiations with the Soviets.

## FINANCING TECHNOLOGY TRANSFER

In examining the requirements for financing the transfer of technology to the Soviets, many serious problems became evident. Following is a summary list of the most important problems connected with potential financing of Soviet-U.S. projects:

1. With the current world-wide inflation and high interest rates, the Soviets will be unable to get money in Western capital-markets at rates which they are ideologically willing to accept, i.e., a maximum of 6 percent.

2. If trade with the Soviets is "subsidized" by financial terms more favorable than given our traditional trading partners, we risk deteriorating relations with these countries. This problem will be aggravated if the U.S. government encourages trade with the Soviets by allowing the Ex-Im bank to offer financing at low interest rates. The Ex-Im bank stresses that they will apply the same standards and financial terms to the U.S.S.R. that they have applied elsewhere, and that U.S.-Soviet trade is to be financed on a routine, non-preferential commercial basis. However, the bankers reply that the Ex-Im bank was set up with the objective of doing business with the Soviets, leans over backwards to help the Soviets, that the Ex-Im's six percent money "sets the tone" for the rest of the banking community, and that it is set up to make loans for a twenty year duration whereas commercial banks are in general geared to make loans for a maximum of ten to twelve years.

3. The combined financial resources of the major world banks may well be insufficient to meet Soviet demand for capital, especially since U.S. banks are legally limited as to the amount they can lend. One banker estimated that the top sixty-eight U.S. banks have only \$1.7 billion legally available for lending.

4. Other capital markets available to the Soviets have certain costs for both sides, viz:

- a. The U.S. domestic capital market: much higher interest rates and the possibility of high Soviet demand influencing the prime rate.
- b. The Euro-market: with its lack of controls, lack of reserve requirements, and its highly volatile nature, Soviet demand could change its entire rate structure.
- c. Middle East oil money: currently overhanging the world's currency structure, however, the possibility exists of putting it together with Soviet capital needs.

5. Will financing the Soviets create a formidable competitor who either can control the particular industrial activity by holding down labor rates, or who purchases needed service and spare parts facilities in Western Europe--or if unable to sell the output of U.S. built and financed plants at normally competitive prices, turns around and dumps the products on the world market?

6. Current lack of convertibility of the ruble coupled with expensive goods due to present official exchange rates hampers trade. In order to translate ruble costs into dollar costs, does the U.S. banker or businessman use official exchange rates, or purchasing power parity rates?

7. What mix of Soviet financing mechanisms will be available to pay for the transfer of technology? One banker felt that the Soviets might employ "... a balancing, which is in effect a portion of exports, a portion of credit and a portion of what they might be able to do as far as the different markets might move, raw materials, gold, whatever...."

8. The Soviet Union's debt service ratio currently amounts to 25 percent and conceivably could rise to 50 percent by 1980. Such a financial burden just would not be economically feasible for the U.S. banking community to support. Given the limitation of debt service, the degree of subsidization will have to be a political decision.

9. If subsidization is deemed necessary, the danger exists that the U.S. citizen will quickly recall the 1973 U.S. grain exports to the Soviet Union and its identification with inflation, high meat prices, and high interest rates--especially with respect to the financing of the purchase of homes.

10. A general unwillingness among the bankers to accept very limited profitability or even loss to establish themselves in the Soviet market.

## PETROLEUM AND NATURAL GAS

The suggestion has been made both abroad and by the Soviets that the Soviet oil industry has the potential to produce a large amount of foreign exchange rapidly on the grounds that large reserves of both crude oil and natural gas are available in Siberia and only require the technology to exploit them. If developed and economically viable, it appears that Soviet philosophy regarding their extractive industries would be a willingness to export one-third to one-half of production provided that the remaining crude oil and gas be channeled back into their economy. It is interesting to note that at present the Soviet Union is a net importer of natural gas.

The key issue here is that these natural resources, as well as certain minerals will only be available for export to the West if the Soviets receive massive injections of Western capital and technology.

At present, the following problems with Soviet petroleum technology exist:

A. Their technology is antiquated (approximately 1930 vintage) and our modern petroleum technology can't be absorbed. As their economy grows, demand for domestic crude oil probably will outstrip its development and distribution. Even now, their Southern oil fields, e.g., Baku, are slightly beyond their maximum efficient production rate (i.e., starting to decline). Furthermore, increased demand by COMECON for Soviet crude oil may be of such magnitude that the Soviets will just not be able to supply the U.S.

B. Soviet drilling equipment--bits, pipe etc. are not the quality to permit rapid, efficient drilling.

C. Exploitation of Siberian oil presents problems in that drilling is difficult, as is the laying of pipe lines for geographic and climatological

reasons, and the Soviets lack the technical capability of building the required 56" pipeline from Irkutsk to Nahodka.

D. Soviets are behind in the technology appropriate for increasing recovery from old oil fields.

E. Soviets lack the organizational and management techniques necessary for this technology.

F. Soviet crude oil, if not competitively priced and if not profitable for the Soviets, will not move into the world market. In an undeveloped area such as offshore, where the Soviets do not have nor understand the technology, they might come to an agreement with the West regarding export of such crude oil.

In addition, the matter of developing Siberian oil is dependent on the total development of the region, i.e., the infrastructure of roads, railroads, new cities etc.

Thus, the question becomes--is it in our best national interest to tie up our capital there rather than somewhere else--such as into the development of oil substitutes in order to decrease our future dependence not only on Soviet oil and gas, but also on the oil and gas of other nations. Also to be examined is the experience the Japanese have had with the Soviets regarding potential Soviet-Japanese petroleum deals. Soviet-Japanese discussions have fallen through due to Soviet inability to guarantee proved reserves. The Japanese have called for a twenty year guarantee of supply of low sulphur crude oil (currently the Japanese burn low sulphur Indonesian crude directly) which the Soviets have been unwilling to commit. The feeling is that when a company or consortium of companies is going to put in a pipeline there should be at least a guarantee of twenty years supply.

Further problems involve the fact that the rate of oil (and other fuels') recovery per cost of equipment used is low in the Soviet Union--due to low recovery rates, poor combustion techniques and rising costs in mining. Soviet industrial output is approximately 60 percent of that of the U.S. while fuel consumption is 84 percent of that of the U.S. Thus for importation of large quantities of Soviet oil, both oil production must be substantially increased and production costs be reduced.

To solve the matter of lower quality drilling equipment and pipe for pipelines, it was felt that mere importation of U.S. equipment would not suffice, but rather the entire technology would have to be transferred--which returns us to the question of what is in our best interest.

From the standpoint of Soviet best interests, would transfer of this technology divert such quantities of resources from other areas as to negate improvement in their total economy? Also mentioned was the thought that the Soviet Union may have a severe energy shortage in the 1980s, which would radically change foreign and domestic priorities, e.g. possibly cutting off energy supplies to COMECON countries or not running natural gas into Moscow and other cities.

Natural gas appears to be the only area in which the Soviets can generate the volume of U.S. credits they need. Some businesses felt that Soviet natural gas reserves (which are estimated to be eight to ten times as large as those of the U.S.) will exceed their needs over the next 15 years and that it can be competitively priced for export. And if by the end of this century other energy sources are available (and economic), the Soviets will be much better off selling their natural

gas now. As a footnote to the above, the United States has a 300 year supply of coal. Others questioned whether the Soviets can really produce natural gas and transport it to port as cheaply as the Algerian can.

With respect to volume of natural gas purchases, the per MCF cost laid down in the appropriate U.S. port would be a prime determinant. Internal transportation charges may or may not represent a cost for the Soviets (as per their internal accounting system) depending on the source of financing for the internal transportation facilities. If financed by the Soviets, internal transportation is a cost; if financed externally, it is not a cost. In the case of natural gas another determinant will be competition offered by coal gasification. As indicated by the Chairman of the Board of Directors of a major U.S. oil company to the U.S. government, "If you give us the same price you're offering the Soviets for natural gas, we've got plenty we can give you for less than that." Then the question arises of what happens then to 20 year gas deals with the Soviets? On the other hand, another businessman felt that Soviet natural gas delivered to the U.S. East coast will be cheaper than coal gas since with present technology, U.S. Eastern coal is not economic to gasify.

Additional problems may arise with Public Utility Commissions if utilities try to buy Soviet gas at say \$2.50/MCF while coal gas is available at \$1.50/MCF. Presumably the severity of such problems will depend on the demand for and supply of all forms of gas, as well as the percentage that Soviet gas would represent in the total gas mix for the U.S.

Impetus to furthering coal gasification technology in the U.S. should come from the Soviet Union's latest position regarding natural gas from Yakutia as reported in the Mainichi Daily News (Tokyo, November 11, 1973).

"The Soviet Union has decided to make a 50 percent increase in export prices of Yakutia natural gas to the United States and Japan, and at the same time it has revised drastically conditions for its economic cooperation with the two countries concerning the Yakutia natural gas development project.

1. Export prices of natural gas to be shipped from Nakhodka to the U.S. and Japan should be increased by 50 percent from 60 cents to 90 cents per million b.t.u. (British thermal unit).
2. The U.S. and Japan should jointly set up three plants for production of steel and iron, metal plates and valves in Siberia. Products of the plants will be used for construction of a pipeline and its accessory facilities to carry natural gas between Yakutsk and Nakhodka. (At present, the U.S. and Japan agree with the Soviet Union to supply necessary products for such construction work.)
3. American bank loans on the development of Yakutia natural gas should be made entirely by the U.S. Export-Import Bank. (Until now, the Soviet had admitted that 50 percent of American financing for the project will be made in the form of loans from the U.S. Ex-Im bank.)
4. Soviet Union will own half of the vessels that carry liquefied natural gas between Nakhodka and American port cities. The earlier accord said that all the vessels will be owned by the American side.

Many industrial sectors take note of the fact that the Soviet Union has begun to take a stronger attitude than ever in negotiations for development of natural resources in Siberia, taking advantage of oil shortages now threatening the U.S. and Japan.

The original agreement on the Yakutia natural gas development project is that the U.S. and Japan will provide bank loans of about \$3.5 billion for the project, and in return receive a more-than-20-year term supply of natural gas developed there.

The Japanese Government and industry circles regard that the tough Soviet position has darkened the prospects of Japan-Soviet joint projects for development of natural resources in Siberia."

As an alternative to the development of Siberian petroleum resources, with all of its attendant problems, it was suggested that the Black Sea littoral might be considered as an area of processing, storage and sales of raw materials much as the Japanese have done.

## AUTOMATED FEED LOTS

The Soviet decision to increase the quantity of domestic beef cattle as well as the amount of animal products in their diet has as its price either the importation of feed grains or the diversion of domestic farmland to feed grains or a combination of the two. Currently, the Soviet Union's already poor Balance of Payments is being further aggravated by hard currency payments for imported agricultural products, viz: U.S. wheat.

In an effort to meet their goal and increase efficiency in this area, Soviet interest has turned to the purchase of large scale, automated feed lots from the U.S. At present, one Colorado firm is providing four automated feed lots--as turn-key plants. This type of highly automated, large scale feed lot has had success in the feed deficient areas of the U.S., such as Southern California, Western Kansas etc.--however its success is highly dependent on a complex and well-developed economic infrastructure such as characterizes the agricultural sector of the United States.

The effectiveness of such feed lots in the Soviet Union came under serious question since the necessary components of the infrastructure are extremely lacking, such as surplus of grain to supply such a system, adequate storage, refrigeration and handling capacities, sufficient means of transport, an effective marketing system to distribute the product as well as any intra-farm marketing. Possibly the greatest deficiency in this area is the lack of all-weather, well maintained roads. As an example of how bad the roads are in the Soviet Union, it was reported that traveling over poor roads accounts for approximately 20 percent of all damage to farm equipment. Under the present administrative set-up,

all rural road construction and maintenance funds have to come out of the infrastructure portion of each Kolkhoz budget. Thus, given the priorities facing the farm manager, road building and improvement are likely to receive minimal attention. In addition, since such feed lots are technologically very advanced, the question of the lack of technical and scheduling (organization, management) expertise arose. It was felt that this highest, or fourth level of technology transfer, as opposed to the lowest, or first, level (production techniques) is difficult to accomplish and absorb. Similar infrastructural requirements such as the presence of extensive land transport and total refrigeration facilities defeats the suggestion of the importation of meat by the Soviets.

On the supply side, the Soviets will have two obstacles to overcome, viz: obtaining sufficient feed from either domestic sources or imports, and where they will obtain feeder cattle. At present beef cattle make up only 3 percent of the total cattle in the Soviet Union and number between two and three million vs. thirty-five to forty million head in the U.S. Most of their feeder cattle input is made up of "rejects" and male calves from dairy herds.

As an investment, automated feed lots involve extremely high capital costs with a low per cow value added thereby calling for a continuous high volume of calves to make the lot pay. This high capital cost is evidenced by U.S. feed lots attempting to contract with large ranches to assure themselves of an assured supply of input.

In attempting to view this matter from a Soviet perspective, it was suggested that the Soviets consider agriculture as part of the infrastructure of type "A" economic activity, i.e., heavy industry and will take care of their agricultural needs and problems by the injection of a

large amount of capital. Ideologically, the Soviets like the idea of large, automated feed lots as it fits in with their self-image of bigness. By Soviet standards, concern with efficiency is not as great as in the West especially when given both the alternatives facing the Soviet planner and the fact that such automated feed lots would not be competing with efficient "normal" feed lots. Thus, the Soviet Union could permit itself certain inefficiencies arising from lack of infrastructure and still derive great improvement over its present position. As an example, Dr. Woroniak pointed to the cost of transporting fertilizers:

"Using Soviet data, in 1967 the cost of transporting fertilizers in the U.S.S.R. was about 700 million rubles. However, the nutritional component in all fertilizers transported (nitrogen content, etc.) amounted to about 200 million rubles, due to low quality of Soviet fertilizers. There is right here a gap of half a billion rubles. If this gap could be reduced or removed through technology transfer so that instead of spending half a billion rubles for nothing only, say, 300 million would be spent for nothing; there still would be a gain of 200 million for the economy."

However, one still is drawn back to the fact that even if the Soviets have the capacity to pay the price, the opportunity costs of doing so will be high, and to the question of whether they will tolerate such diversion of resources and the concomitant costs.

## OTHER AREAS OF TECHNOLOGY TRANSFER

Chemicals

In the early 1960s, the Soviets recognized that the chemical industry was not just important to the military, but also was important vis-a-vis agriculture and consumer goods, through fertilizer and synthetic fibers, respectively. In deciding to give priority to this industry, it both produced and imported plant and equipment with imports accounting yearly for 40 to 50 percent of the total fixed investment. Via the importation of plant and equipment (embodying technology) from the U.K., the Soviets were able to avoid the phase in which they are the least proficient, i.e., turning applied research into commercial operations.

The Soviet Union, in this instance, has been paying a high price to get what they want sooner both in terms of their plants being less efficient than comparable plants in the U.K. (or U.S.) as well as in lack of proper planning as to how fast the industry was able to absorb new technology--resulting in serious delays in plant start-ups.

However, both the U.K. and the Soviet Union may gain as the Soviet Union obtains the technology and products earlier and the United Kingdom gets a high enough price to be able to run the risk of receiving poor quality chemicals in the future.

Timber

Quite simply, there is not sufficient wood of the right type nor of the right mix located where it would be economic to exploit it for export. Currently, transportation accounts for 50-60 percent of the cost of timber in the U.S.S.R.

Aircraft

This area appeared to be one of the most promising, although total potential export earnings would only amount to \$1-1½ billion. The tri-jet Yak-40 has shown the most promise in that it is priced approximately \$½ million lower than comparable foreign airplanes, and significantly, has Western (Italian and German) spare part and maintenance support.

The Soviets have somewhat of a natural advantage in that their internal airline is large enough to purchase the quantity of aircraft necessary to both make the aircraft builder profitable and export the surplus.

Semi-Finished Steel Products

Such products as exportables offer the advantage that less would be sacrificed in the nature of resource version to obtain foreign exchange. The main problem here is that the principal steel making countries have excess steel making capacity. With a slight comparative advantage in the production of semi-finished steel products, it was suggested that the Soviets could ship such semi-finished items to Germany to be transformed into finished products and then sold to the U.S. for dollars--thus generating needed foreign exchange. In such a market, however, there always exists the possibility of being undersold by a country also having excess steel capacity, thereby forcing the Soviets to dump and negating any gain for them.

In fact the Soviets are proceeding very slowly on the idea of shipping semi-finished steel to the Ruhr area. It was also noted that domestic usage of steel in the Soviet Union exceeds the buildup of ore for possible export purposes.

Finally, the Soviets express a dislike for tri-lateral trade arrangements fearing that they might end up bearing the brunt of the cost in such "circular"

### Housing

While lack of housing appears to be the primary cause of the high degree of labor "mobility," the Soviet plan does not include a large increase in this area. Shortage of labor and materials coupled with an ideological fear of opening the housing construction area to the private sector are responsible for the lack of Soviet emphasis. Leninist theory runs counter to the Western practice of housing allocation being based on a schedule of rents and rental on better housing being bidded up--thereby stimulating and financing new construction. Therefore, housing is precluded as an economic activity which might be used to sop up extra purchasing power.

### Computer Technology

This area represents one which could serve the Soviets in a three-fold sense. First, there exists a definite need and priority for computers in operational areas--since their current efficiency in operational matters is low. Second, computers could represent a vehicle to enable the Soviets to institute certain desirable changes without encountering political opposition. Third, EDP technology would aid both the planner and the plant manager in the decision-making process by permitting rapid processing and analysis of data.

With reference to this third point, one may ask whether it really is a question of computers and EDP technology, or whether one of intelligently designed management information systems which will enable decision-makers to arrive at timely, correct decisions.

### Transfer of Technology to the United States

Recently, several U.S. firms negotiated for the technology to process low grade bauxite, an area in which the Soviets have had extensive experience (the U.S. has only had experience with high-grade bauxite).

## CONCLUSION

To conclude this digest, it is useful to examine the consensus arrived at for each of the five principal questions asked.

First, the adequacy of Soviet economic infra-structure to absorb sophisticated technology, including up-to-date managerial and decision-making skills, was seriously doubted. Sheer absence of an advanced economic infra-structure, ranging from a poor road network to a lack of marketing expertise, will be a very grave obstacle to their absorption of technology. To sell the Soviets complex technologies and have such transfers fail will entail severe domestic political costs on both sides, as well as serious economic losses for both countries--the U.S. unable to recoup its investment plus profits, and the Soviet Union incurring high costs to divert resources to create the necessary economic infra-structure as well as loss of any profits on the particular activity.

Second, serious inadequacies exist in the current Soviet organizational and institutional arrangement when considering ability to support the kind and level of trade indicated by large-scale technology transfer. The conflict between planners' and plant managers' objectives, the lack of a smooth flow from research work to product development, fear of being "contaminated" by Western values, lack of scheduling expertise, lack of service and spare parts capabilities, inability to rapidly shift priorities, preoccupation with military considerations, and lack of necessary business and economic data, all serve as obstacles which are going to be difficult to overcome.

On the U.S. side, the potential of U.S. Labor to view the transfer of technology and its use of low-cost Soviet labor as akin to the Mexican

Border Industrialization Program raises problems. Additionally, U.S. businessmen have not had time to acquire the necessary experience nor the organizational structure to deal effectively with the Soviets on a commercial basis.

The question of what the Soviets want to import was fairly clear while what and how much the Soviets could export posed problems. In short, it appeared that only natural gas, while entailing high infrastructural costs, offered the Soviets the best long-term opportunity to earn sufficient foreign exchange to finance the volume of technology transfer desired. Automated feedlots appear to entail two great infrastructural costs, while future domestic and COMECON demand is likely to stop up any increased crude oil production. The export of semi-finished structural steel appeared to pose the least excess steel-making capacity abroad precludes steel as a significant export. The remainder of possible exports, i.e., aircraft, inexpensive television sets, transistor radios, and invisible exports, such as shipping and tourism, either are unattractive to the U.S. market or just won't generate sufficient foreign exchange.

Last, the most serious obstacles appear on the financing end with a limit to the amount of capital available to the Soviets--especially given their "Ideological Insistence" on low (6-7 percent) interest rates, an already high debt service ratio, and the danger of alienating our traditional trading partners by "subsidizing" trade with the Soviets.

In brief, the potential for large-scale, ongoing U.S. transfer of technology to the U.S.S.R. and a high level of two-way trade looks highly problematic at this time.